Diversification through Innovation: Prospects for Growth
Diversification through Innovation: Prospects for Growth
The Knowledge Economy Forum (KEF) is the most important annual World Bank conference for the regions of Central and Eastern Europe, Russia, the Commonwealth of Independent States and Central Asia (ECA). The conference focuses on innovation management, international science-business networks as well as current developments in the target region. Moreover, the KEF addresses issues of knowledge and technology transfer, international innovation networks, and reforms aiming at strengthening the competitiveness of the region. The KEF is an exclusive event; participants range from ministers and high-level government officials of national and re-gional ministries of economics and research to distinguished representatives of industry, internationally renowned universities, and research institutions.

The annual multiday conference is jointly hosted by the World Bank and a partner organization from the respective host country. For the 2010 Berlin Forum on “Diversification through Innovation: Prospects for Growth”, the World Bank worked closely with the Fraunhofer Center for Central and Eastern Europe (MOEZ). The MOEZ is the strategic partner of industry, research, and politics for networking and collaboration with policy makers in Central and Eastern European growth markets. The institute focuses on fundamental transformation processes in a globalized world, such as the development towards a knowledge economy, global shifts in value creation processes, and the growing need to pursue sustainable development strategies at regional and international levels.

The primary objectives of the 9th Knowledge Economy Forum were:

1. The design and development of policies to improve the effectiveness and efficiency of national innovation systems through economic diversification, the modernization of higher education institutions, and the support of commercialization of national R&D.

2. Discussions on the potential impact and finetuning of diversification policies via an exchange of experiences among international experts, representatives of government entities, research institutions and business constituencies from ECA and advanced EU countries.

3. A strengthening of the dialogue and coordination between clients, donors, and multilateral organizations to improve the relevance and quality of technical assistance (TA) and operational support on all initiatives related to promoting innovation-driven growth.

The KEF IX was organized along two key themes, namely “Diversification” and “Showcasing the German Enterprise and Research Sector”.

As ECA countries are striving to devise paths to emerge from the economic crisis, some have realized their vulnerability in remaining largely resource-driven economies. There is a growing need for diversification and an acceptance of supporting knowledge-driven growth. In this context, the KEF sought to formulate policy proposals for economic diversification.

Professors Ricardo Hausmann and Bill Maloney discussed Diversification Strategies during Plenary Session II on May 5, 2010. Other high-level discussants of a related “Hard Talk” panel discussion included the Deputy Prime Minister and Minister of Science of Serbia, Mr. Bozidar Djelic, and the Minister of Economy of Armenia, Mr. Nerses Yeritsyan. The foundation of this session was provided by an overview of the economic impact of the crisis on the ECA region; in particular, its effects on innovation and R&D activity at the enterprise level throughout the region.

As a next step, the Forum explored the case of the German Mittelstand SME sector, focusing on support policies and programs that have enabled innovation-driven development
within the context of German unification. In this regard, the discussion addressed the German research and innovation system and its ability to effectively link publicly financed research with the needs of a dynamic private sector. Distinguished speakers, including the Presidents of the Max Planck and Fraunhofer Societies and the German Academy of Science and Engineering, provided an overview of the research system during Plenary Session VIII on May 6, 2010.

This topic had also been at the core of the previous KEF (VIII), where the discussion had focused on the reform of public Research and Development Institutes (RDIs) in ECA countries.

Plenary Session VII addressed the transition of EU policies from the Lisbon Agenda to the EU 2020 Strategy, discussing the future of R&D, higher education, and innovation policies as enablers for competitiveness. Speakers included Gerard de Graaf of the European Commission as well as the Minister of Education and Science of Lithuania, Mr. Gintaras Steponavieius.

The audience consisted of ministerial expert-level representatives from various kinds of ministries (primarily economics, industry and trade; science and technology; research and education; finance); heads of R&D institutions as well as incubation support and technology transfer programs; reform-minded leaders of higher education institutions; dynamic private sector representatives interested in influencing the dialogue on the relevance of public research and innovative skill match; specialists in areas addressed by the forum; young entrepreneurs and scientists form the ECA client countries; and representatives of civil society.

The organizers had invited delegations from across the ECA region to attend KEF IX including participants from Albania, Armenia, Azerbaijan, Belarus, Bosnia-Herzegovina, Bulgaria, Croatia, the Czech Republic, Estonia, FYR Macedonia, Georgia, Hungary, Kazakhstan, Kosovo, Kyrgyz Republic, Latvia, Lithuania, Moldova, Montenegro, Poland, Romania, the Russian Federation, Serbia, Slovakia, Slovenia, Tajikistan, Turkey, Ukraine, Turkmenistan and Uzbekistan.

Presentations have been taken from the website: www.knowledgeeconomy.com

Photo: Prof. Dr. Hans-Jörg Bullinger, President of the Fraunhofer Gesellschaft
THEME 1: DIVERSIFICATION IN A POST-CRISIS WORLD  

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Innovation in a Fiscally Strapped Environment  
Enterprise Financial Crisis Assessment Survey: Impact of Global Economic Crisis on Corporate Sector in ECA  
A View from Russia  

Plenary II: Diversification Strategies  
Diversification: Why and How?  
Diversification, Innovation and Growth  
Panel Discussion  

THEME 2: POLICY AND PROGRAMS OF INNOVATION AND COMMERCIALIZATION  

Plenary III: Supporting Innovative SMEs  
Post-Transition Technology Absorption – What Can ECA Learn from Germany?  
Entrepreneurial Regions – the BMBF Innovation Initiative for the New German Länder  
Experiences with the Innovation Assistant Program 1995 – 2008  
Financial Instruments in Support of Innovation  
Financing Innovation  
Discussant: Prof. Dr. Thorsten Posselt, Director, Fraunhofer Center for Central and Eastern Europe (MOEZ)  
Creating Sustainable Businesses in the Knowledge Economy  

Plenary IV: Commercialization of Public R&D  
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Plenary I: Impact of the Crisis on Innovation

This session provided an overview of post-crisis trends in the Europe and Central Asia (ECA) region, examining their implications for the development of the innovation agenda and R&D investment in the region. The session was led by World Bank ECA Chief Economist Indermit Gill, who discussed the prospects for further economic growth in the region and strategies for recovery. He was followed by Paulo Guilherme Correa, who presented the findings of a regional enterprise survey, which exhibited the effects of the crisis on the promotion of innovation by the private sector in the region. Ksenia Yudaeva of Sberbank then shared with the audience a case study on the effects of the crisis on Russian banks and innovation financing.
Indermit Gill outlined the situation of fiscal divergence (concerning deficits, revenues and expenditures) in the ECA countries before, during and after the crisis. Before the crisis, deficits were shrinking and in some countries even surpluses were recorded. ECA countries experienced high growth rates and an improving fiscal position due to good fiscal policies (with the exception of the EU-10 countries, where the fiscal position deteriorated slightly after their EU accession).

During the crisis, divergence increased. In Europe, some countries already recorded huge deficits, whereas some Mediterranean countries had only medium-size deficits and some (especially the oil exporting countries) had almost no deficit. However, huge increases in debt levels were recorded almost everywhere. Energy exporting countries employed high fiscal stimuli (rainfall funds), whereas all other ECA countries had no or only very small stimulus programs.

For the post-crisis period (2010 to 2015), a further increase in divergences can be forecast. In comparison to previous medium-term forecasts, the outlook for growth is much more subdued after the crisis. All in all, spending needs (on education, infrastructure etc.) will stay high, but revenues will not grow fast. Therefore, fiscal consolidation is urgently needed. Fiscal reforms need to be geared to individual problems; in the Western ECA region social systems are very costly, in Eastern countries energy subsidies are particularly problematic.
Main points

1. Before the crisis, fiscal performance improved across the region
   - Revenues rose, deficits fell, and fiscal policies improved with few exceptions

2. During the crisis, fiscal policy responses differed in the east and west
   - Reliance on automatic stabilizers in most countries
   - Fiscal stimulus programs in resource-rich economies.

3. After the crisis, fiscal adjustment priorities will be even more differentiated
   - Education and infrastructure in much of region
   - Social insurance in Central and Southern Europe
   - Reducing stimulus and energy subsidies in middle-income Former Soviet Union

Backdrop

- Emerging Europe and Central Asia hit harder than other developing regions
- Growth and fiscal prospects for the region are bleaker than for others
- The region also has a daunting climate action agenda
THEME 1: DIVERSIFICATION IN A POST-CRISIS WORLD

**Worst fiscal performance**

Fiscal Balance, Percentage of GDP (2005-2013)

- Africa
- Developing Asia
- Latin America
- Middle East
- Europe and Central Asia

**Weakest growth prospects**

Real GDP Growth, Annual percentage rate (2005-2013)

- Africa
- Developing Asia
- Latin America
- Middle East
- Europe and Central Asia
THEME 1: DIVERSIFICATION IN A POST-CRISIS WORLD

### Highest energy intensity

Energy intensity of GDP (kilotons per GDP PPP, $, 2000)

- **1990**: 1.5
- **1994**: 1.1
- **1998**: 0.7
- **2002**: 0.3

**Countries: EAP, ECA, OECD, LAC, MENA, AFR, SAR**

### Before the crisis

- Revenues rose rapidly as trade and consumption based tax collections increased
- Spending rose almost as fast in aggregate, but steady as share of GDP
- Fiscal balances improved across the region, with a few exceptions (Hungary and Georgia)
- But budgeting and spending efficiency did not improve as much
THEME 1: DIVERSIFICATION IN A POST-CRISIS WORLD

Revenues rose

Steady increase as share of GDP, but aggregate increased from $700bn in 2000 to $1.2 trillion in 2007

General Government Revenue, 2000-2007 (% of GDP)

Spending up almost as much

Steady as a share of GDP, but rose in aggregate from $700 billion to $1.1 trillion

General Government Spending, 2000-2007 (% of GDP)
THEME 1: DIVERSIFICATION IN A POST-CRISIS WORLD

Fiscal balances got better

Spending increased in east, more controlled in the west

Composition of changes in the fiscal balance, 2000-2007 (% GDP)

Fiscal policies improved

Outside the EU-10, the quality of fiscal policy improved

THEME 1: DIVERSIFICATION IN A POST-CRISIS WORLD

Public R&D spending rose

In the EU-10 and Turkey, spending on R&D increased

Research and Development (% of GDP), median values

Source: World Bank, ECA Regional Tables.

During the Crisis

- Government revenues fell everywhere, but more in the east
- Public spending rose as a share of GDP, but stable in aggregate
- Fiscal balances deteriorated everywhere, but more in the east
- Oil and gas exporters implemented fiscal stimulus programs, but exit unclear
THEME 1: DIVERSIFICATION IN A POST-CRISIS WORLD

All relied on automatic stabilizers

Only ECA’s oil exporters implemented discretionary fiscal stimulus programs

Contributions of changes in deficits, 2008-2009, % of GDP, median values

- Change in fiscal stance  - Automatic stabilizers  - Fiscal balance (change from 2008)

Big fiscal imbalances emerged

Expenditures responsible for rising deficits everywhere; big revenue declines in SE Europe and parts of the CIS

Contributions of changes in deficits in 2007-2010, share of GDP

- Expenditure  - Revenue  - Balance

EU-10  S.E. Europe + Turkey  Other CIS  EU-15  EAP  LCR
And public debt has grown
Public debt in Central and Southern Europe, and the non-oil rich CIS will be close to 40 percent in 2010

After the crisis

- Growth projected not to recover to pre-crisis levels
- Fiscal stimulus programs will not deliver growth
- Pressures to increase spending
- Projected divergence in spending and revenue trends within the region
Lower growth post-crisis

GDP growth in 2010 will be about 5 percentage points lower than what was expected before the crisis.

Projected economic growth rates, before and after crisis:

- EU10
- S.E. Europe + Turkey
- Middle-income CIS
- Low-income CIS

More pressure to reform pensions

ECA’s spending on social security resembles that in wealthier countries.

Spending on social assistance and insurance, % of GDP; most data from 2000 to 2003.

Source: World Bank staff and OECD Social Expenditure Database.
THEME 1: DIVERSIFICATION IN A POST-CRISIS WORLD

More pressure to invest in education

More enterprises are complaining that the skills of workers are becoming an obstacle for business

Source: BEEPS 2005 & 2008; percentage of firms indicating that skills and education of available workers is some form of constraint on business.

More pressure to invest in infrastructure

More enterprises are complaining that electricity is becoming an obstacle for doing business

Source: BEEPS 2005 & 2008; percentage of firms indicating that electricity is some form of constraint on business.
THEME 1: DIVERSIFICATION IN A POST-CRISIS WORLD

Divergence in region will grow

EU-10 adjustments will resemble those in middle income countries in East Asia and Latin America

Forecasted Adjustments (2009 to 2013)

-8 -7 -6 -5 -4 -3 -2 -1 0 1 2

EU-10  S.E. Europe + Turkey  Oil Exporting CIS  Other CIS  EAP  LCR

Expenditure  Revenue

Fiscal consolidation

- Requires a closer look by country
- Requires making social sector reform a priority in many countries
- Requires reducing energy subsidies in much of the former Soviet Union
- Requires exit strategies from fiscal stimulus in oil and gas exporting countries
Post-crisis pressures

- **Slower growth** likely for most economies
  - ECA may not go back to pre-crisis growth rates soon
- Many governments will be **fiscally weaker**
  - Public debt levels will be higher after the crisis, and tax revenues possibly structurally diminished
- More pressure to address **climate change**
  - Pressure on emerging Europe to mitigate, on Eurasian countries to adapt

Governments in ECA are bigger

Government spending is greater than in Latin America and Emerging Asia today (and Germany in 1960)

*Share of Spending in GDP, latest year*

*Note: Plot values reflect ECA countries*
THEME 1: DIVERSIFICATION IN A POST-CRISIS WORLD

Social benefits and wage bills are high in the west

Social spending and employee compensation dominates the budget

Energy subsidies are big in the east

Energy is priced below cost in much of the former Soviet Union

Source: ERRA Tariff Database; weighted average electricity tariffs for residential consumers in 2008, US$ cents / KWh.
Seven cases

Automatic stabilizers and discretionary spending helped during 2009, except in Ukraine and Serbia

Composition of change in fiscal balance, 2009

Priorities differ by country

Social security and education needs reform in many, combined with idiosyncratic mix of priorities

<table>
<thead>
<tr>
<th>Social Sectors</th>
<th>Productive Sectors</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pensins</td>
<td>Education</td>
<td></td>
</tr>
<tr>
<td>Russia</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Poland</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Ukraine</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Serbia</td>
<td>X</td>
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<tr>
<td>Turkey</td>
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<tr>
<td>Russia</td>
<td>X</td>
<td></td>
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<tr>
<td>Kazakhstan</td>
<td></td>
<td>X</td>
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<tr>
<td>Armenia</td>
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<td>X</td>
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</tbody>
</table>

Source: World Bank Public Expenditure reviews and Development Policy Loan documents; see annexed case study summaries.
Conclusion: Tough fiscal prospects

- **Before the crisis:** Between 2000 and 2007, buoyant revenues allowed big spending increases—but fiscal balances were improved.
- **During the crisis:** Revenues fell in much of the region, spending was steadied by automatic stabilizers in many and stimulus spending in a few—but fiscal balances deteriorated in most.
- **After the crisis:** Crisis made fiscal reform priorities clearer and more differentiated between countries—but generally tighter fiscal circumstances likely.
Paulo Guilherme Correa introduced the results of the Enterprise Financial Crisis Assessment Survey (second wave, from January to March 2010). According to the survey's main findings, firstly, most companies maintained their current level of R&D expenditures in 2009 (including the world largest R&D spenders). However, expenditures decreased for example in Lithuania, Romania and Bulgaria; countries that had shown very low R&D intensity already before the crisis. Secondly, public support to R&D decreased in the ECA region, which is a sharp contrast to the OECD region. Thirdly, the growth rate of innovative and export-oriented companies was positive.

After the crisis, R&D will be important for GDP and export growth. Developed countries have already included measures to foster R&D and innovations in their “stimulus packages”. Existing innovation policies should be reformed to raise their impact on firms’ productivity. This can be achieved by rebalancing priorities of public R&D expenditures (public vs. private sector, basic vs. applied research), by cutting costs of public research organizations, by promoting the commercialization of R&D (aligning the IPR regime of public private research etc.), and by improving governance regimes.

Innovation and R&D during the crisis: Preparing for the upturn
Evidence from firm-level data for selected ECA countries
**Four Key Messages**

1. Despite the crisis, most companies in the ECA region managed to keep or expand R&D expenditures.
2. Due to serious fiscal constraints, public support to R&D and innovation was sometimes reduced in the ECA region (a sharp contrast to OECD countries).
3. Yet innovation and R&D will be important sources of GDP and export growth in the post-crisis period.
4. In this context, renewed efforts to increase the impact of innovation policies on competitiveness (more “bang for the buck”) will be needed from policymakers.

**The global financial crisis hit hard companies in ECA**

- Net change in sales (2009/2008 and 2010/2009), by country
- Change in capacity utilization (compared to 2007), by country

Source: World Bank EPCS 2010
**Theme 1: Diversification in a Post-Crisis World**

- **Firms responded by increasing the use of internal funds to finance working capital and delaying payments**
  - Percent of firms that use internal funds or retained earnings to finance 100% of their working capital
  - Percent of firms that delayed payment for more than one week in Jan 2010
  - Source: World Bank EFCS 2010

- **Sales decline was large for innovative firms**
  - The sales growth rate of innovative companies has decreased around 16 percentage points more than the sales growth rate of non-innovative over time, at 5% level of significance.
  - Results correspond to panel data estimators, controlling for firm characteristics (age, skill of workforce, size, export orientation, country and sector).
**Why?**

- When comparing innovative firms that are export-oriented with innovative firms that are domestically oriented, we found that:
  - the sales’ growth rate of innovative and export-oriented companies was positive while the sales’ growth rate of innovative and domestic oriented companies has been negative

- Tentative interpretations:
  - Innovative and export-oriented firms were able to better diversify market-risk (and thus were less affected by demand fluctuations in one single country)
  - Innovative and export-oriented firms supply goods with higher “intrinsic value” (and thus have higher monopoly power despite operating in an international market)

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**Most of the innovative firms managed to keep or expand their R&D investments in 2009**

- Within firms who performed R&D activities before the crisis, only 27.8% (about 39,000 firms in the 7 surveyed countries) have decreased their R&D spending in 2009
  - This proportion is (significantly) higher...
    - In Romania (45.3%), Lithuania (45.2%) and Bulgaria (32.3%)
    - for non-foreign owned firms (28.8%)
    - for small firms (30.8%)
  - Decreasing R&D firms used to have the lowest R&D intensity before the crisis

![Average R&D intensity and R&D share in the country (before the crisis), by R&D change in 2009](source: World Bank EFCS.2010)
The performance of the group of world largest R&D spenders is similar

- According to a Booz-Allen survey of 1,000 public corporations worldwide that spent the most on researching and developing products and services approximately 2/3 kept or increased their R&D spending.
  - R&D spending for the top 20 companies was up 3.2 percent for 2008, less than half the 10.7 percent increase for the previous year
  - Toyota (-5.7%), GM (-1.2%), Ford (-2.7%) and Honda (-4.2%) concentrated the bulk of the decline, reflecting the crisis in the automobile industry.
  - Pharmaceutical; Electronic and software sector did not show any dominant pattern – with Astra Zeneca (16.4%); Samsung (16.2%) and Microsoft (14.6%) presenting the largest increases.

Developed nations have included measures to foster R&D and innovation in their “stimulus packages”

- Three-quarters of OECD countries took additional measures to foster innovation after the crisis
- Countries were split evenly between those that increased R&D tax credits and those that provided additional direct grants for business R&D
- Some did both (e.g. France, Japan, Norway, and the U.S.)
- A much smaller number of countries also increased direct funding for public R&D
- The American Recovery and Reinvestment Act will provide USD 652 billion from 2009 to 2011 (USD 787 billion in support from Feb. 2009 2019)

Incentives to R&D and innovation were sometimes reduced in ECA countries

- **Latvia** is cutting R&D budget for project-based funding (from €10.4m in 2008 to €6.0m in 2010)
- In **Romania**, according to the 2007-2013 National RDI Plan, the money assigned to R&D was €139m, that is below the amount provided in the 2008 budget
- Fiscal constraints in most **Central European** countries did not allow for the adoption of fiscal stimulus packages and often imposed dramatic expenditure cuts
  - For example, Latvia, Lithuania and Romania will need to undergo fiscal adjustments of at least 7% of GDP (primary balance)

Yet innovation and R&D will be important sources of GDP and export growth in the post-crisis period

- The region’s pre-crisis growth path – often based on aggregate demand and growing current account deficits – needs eventually to be replaced by one based on productivity gains and innovation
- Natural resource exporting countries suffered steep downturns in economic activity highlighting the importance of export diversification (and in that context innovation)
- The **OECD** estimates that that increasing R&D by 0.1% points could raise GDP by about 1.2% in the long-run
- Reaching the Lisbon Agenda R&D target (3% of GDP) is expected to raise GDP up to 13% and exports up to 16%.
The effects of Lisbon Agenda R&D target in 2025: simulations on the WorldScan Model

<table>
<thead>
<tr>
<th>Country</th>
<th>GDP</th>
<th>Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Croatia</td>
<td>6.0</td>
<td>12.9</td>
</tr>
<tr>
<td>Poland</td>
<td>5.5</td>
<td>8.5</td>
</tr>
<tr>
<td>Romania</td>
<td>11.7</td>
<td>13.5</td>
</tr>
<tr>
<td>Hungary</td>
<td>6.4</td>
<td>8.0</td>
</tr>
<tr>
<td>Slovakia</td>
<td>8.9</td>
<td>10.4</td>
</tr>
<tr>
<td>Slovenia</td>
<td>6.9</td>
<td>10.5</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>13.1</td>
<td>8.3</td>
</tr>
</tbody>
</table>

The numbers are cumulative changes that result achieving 3% target as compared to the baseline in 2025.


Reforming existing innovation policies to raise their impact on firms’ innovation and productivity

Innovation Policy for Competitiveness: Preparing for the Upturn

– Rebalancing country priorities on public R&D expenditures, especially in terms of public vs. business sector (also basic vs. applied research)
– Adopting cost saving measures in public research organization (encouraging PRO to reach out the market)
– Preserving public support to private R&D (possibly increasing tax breaks and raising matching-grants available to SMEs)
– Promoting the commercialization of public research (aligning the IPR regime of public financed research; supporting technology transfer offices; providing early stage financing and strengthening policies to nurture start-ups)
– Improving the governance regime: coordination; participation of the business sector and evaluation of existing programs
THEME 1: DIVERSIFICATION IN A POST-CRISIS WORLD

R&D decline seems linked to firm liquidity and age

Average share of short term liabilities in 2010, by R&D change in 2009

- Decreasing R&D firms in 2009 have higher share of short term liabilities
- When performing an ordered probit model – controlling for size, age, export orientation, country and sector - the results show that:
  - the probability of having decreased R&D spending in 2009 increases (significantly) for overdue firms and young firms (<5 years old)

Source: World Bank EFCIS 2010

The crisis effect on innovation differs by firm size

- Across all firm sizes, more than half of firms kept their current level of R&D expenditures.
- Of those that changed, 25% of Small Firms decreased R&D expenditures. Comparatively, 17.2% of medium sized firms spent less in R&D, as well as 19.9% of large firms.
  - The highest proportion of Small Firms (less than 20 employees) with R&D decreases is found in Turkey (33.3%), Romania (32.5%) and Lithuania (34.9%)
- However, in specific countries, Medium and Large Firms are relatively more affected:
  a) The proportion of medium sized firms (20-99 employees) that decreased R&D expenditures is specially higher in Romania (33.6%) and Lithuania (34.7%)
  b) As well, a relatively high proportion of large firms (>100 employees) decreased R&D expenditures in Bulgaria (39%), Lithuania (35.5%) and Romania (29.7%)
Innovation efforts of foreign firms are less affected by the crisis when compared to locally owned

- 27.8% of foreign owned firms increased R&D expenditures compared to 19% of locally owned.

- Contrastingly, 23.4% of locally owned firms decreased R&D compared to 16.6% of foreign owned.

  - Many foreign firms in Turkey are using the downturn to prepare better for the rebound, 54% are increasing R&D expenditures.

  - On the contrary, 40% of foreign firms in Romania are cutting R&D expenditures.
THEME 1: DIVERSIFICATION IN A POST-CRISIS WORLD

R&D change by ownership
Ksenia Yudaeva portrayed the innovation strategies of Russia. At the beginning of the economic crisis, Russia experienced a sharp outflow of capital. R&D activity in companies as well as training programs decreased significantly. In addition, governmental financial support for start-ups fell. Only 25% of Russian firms estimated their technological level to be comparable with foreign companies.

Russia needs a diversification strategy, competitive sectors and innovation-driven growth. Foreign companies give major boost for innovation. Drawbacks for the economic development are low levels of entrepreneurship, the lack of management skills, an insufficient use of IPR, an unfriendly business climate, and the incomplete recovery of the banking system.
Has crisis affected innovations in Russia? – The short answer is “NO”: If something does not exist, nothing can affect it.

Pre-crisis situation according to the HSE 2009 enterprise survey:

- Only 25% of firms self estimate their technological level as equivalent to the level of their foreign competitors.
- Share of firms, doing R&D, decreased from 37% in 2004 to 29% in 2008. However, R&D spendings, conditioning on doing R&D, increased.
- Share of firms, having training programs for employees decreased from 69% in 2004 to 50% in 2008. Only in 25% of firms training programs cover more than 10% of personnel.
THEME 1: DIVERSIFICATION IN A POST-CRISIS WORLD

What about startups?

- Prior to the crisis a number of “development institutions” was established by the government to support innovations:
  - Rusnano (support of business and infrastructure development in nanotechnologies). Government support initially was equal to 130 bn rubles ($4.4 bn), but in 2009 it was cut in half until 2011. At the moment Rusnano invested at about 38 projects; total investments in the projects equal to 96 bn. Rubles, Rusnano investments 51.8 bn Rubles.
  - Russian venture company (support of venture funds and infrastructure building). Initial government support 30 bn. Rubles. At the moment 7 venture funds were supported with overall capital of 19 bn. Rubles. As of November 2009 only 18% of capital was invested.
  - Small business in science and technology support fund. Total budget in 2009-2010 is 4.8 bn. Rubles. Normally finances 800 projects per year. Results by now:
    - More than 2000 innovation companies
    - More than 15 000 jobs
    - 3 000 young researchers supported by the government
  - Technology commercialization SEZ. Currently 4 SEZ exists: 162 projects with overall costs of 121.5 bn. Rubles.

- Effect of the crisis: financing was reduced, but it has never been and has not became a binding factor.
I. Development and lessons from the crisis: timing and transmission channels


High oil prices  High capital outflow  Green shoots and stabilization of the world economy
Credit boom  Financial crisis  Commodity prices bounced back
Lack of proper risk management  Credit crunch  => Stabilization in Russia
Insufficient prudent regulation  Devaluation  CBR got opportunity to cut interest rates
High volatility  NPL crisis in banking sector
High level of mistrust

Crisis transmitted to the Russian economy through the following channels: 1) sharp capital outflow 2) collapse of commodity prices 3) “sudden stop” in world credit markets. (see the next slide)
Because of distrust into national currency CBR was unable to provide loose monetary policy from the very beginning. Only in Q2 2009 it began to cut interest rate. Future economic situation largely depends on developments in the world economy.
I. Development and lessons of crisis: lessons

Russia was among the countries most severely hit by the crisis

Lessons Russia has to learn

Macroeconomic policy

In 1999-2008 Russian policy aimed at sustaining growth through ER management, but it missed to stabilize inflation expectations. Massive capital outflows at the beginning of the crisis provoked run from the national currency. As a result Government and Central Bank were unable to weaken policy to the extend sufficient for support of the economy.

Banking sector regulation

Due to lack of restructuring banking sector remained weak and segmented before the crisis. In addition Russia experienced classic credit boom. As crisis unfolded this resulted in high NPL level and poor banks’ balances. To avoid future crises reforms in financial sector are necessary, including prudential regulation in accordance with G20 recommendations, and banking sector consolidation.

REAL ECONOMY: Recovery started, but not stable yet

3rd and 4th quarters of 2009 see increasing positive input into GDP from export and inventories cycle.
THEME 1: DIVERSIFICATION IN A POST-CRISIS WORLD

REAL ECONOMY: Regional perspective

- Large group of regions reached pre-crisis level of output already

V-recovery
- N.Novgorod, Kursk, Moscow oblast, Tula, Kaliningrad, Lipetsk

L-recession
- Orel, Samara, Tver, Bryansk, Kurgan, Chuvashia, Ivanovo, Vladimir

DRIVERS OF GROWTH: Oil and gas markets

Oil prices

Natural gas
- Gasprom
- European market (TTF)

Supply and demand on oil market

China imports
- Oil
- Iron ore
- Copper
- Aluminium

High demand from China and discipline in OPEK permitted quick recovery in energy and raw materials demand. Natural gas sector, where market goes through structural changes, is an exception.
The Theme 1: Diversification in a Post-Crisis World

Drivers of Growth: Metal Markets

Aluminium

Nickel

Copper

Steel (Mediterranean)

Drivers of Growth: Stock Markets

Stock Indices

Stocks in Oil and Gas Sector

Stocks in Manufacturing Sector

Stocks in Financial Sector

Excess liquidity on global financial markets leads to a rally on world and Russian stock markets. Energy out-performs while manufacturing under-performs.
THEME 1: DIVERSIFICATION IN A POST-CRISIS WORLD

**DRIVERS OF GROWTH: Bond markets**

- Corporate bonds market
  - New issues
  - Market volume
  - Billion, rubles
- Eurobonds
  - $ USD

**Loan rates and bond yield**

- Corporate bond market boom and IPO perspectives enhance financial situation for large Russian companies. Medium and small businesses are in a more difficult situation.

**CHALLENGES AND RISKS: Financial sector**

- Credit to real sector
  - Nominal index, Jan 08 = 1
- Payments overdue
  - % from total pay-off
- Credit and deposit rates
  - Loan rate
  - Deposit rate (w/o demand deposits)
- Reserves and bad loans
  - % from total loans
Theme 1: Diversification in a Post-Crisis World

Survey data: credit availability and usage or credit

- According to HSE survey: prior to crises competitive firms financed most of their investments from retained earnings. Leverage was larger in non-competitive firms.
- Sberbank survey: only 10% apply for credit because of needs to finance investment projects
- Sberbank survey: because of crisis 63-93% of firms cut down their investment plans.

Effect of the crisis on different industries:

Source: Center for Macroeconomic analysis and Short-Term forecasting
Some lessons from the crisis:

- Natural resource dependence was a positive factor which speeded up initial stage of recovery.
- Noncompetitiveness of cyclical sectors slows recovery down.

Crisis have shown that technological modernization is important not only for long-term development but also for more balanced growth.

Current policies in innovation sphere

- Rusnano and RVC are getting more active in creating innovations ecosystem
- Techno park in Skolkovo
- President committee on modernization of economy
- The fact that budget switched from 6% surplus to 6.5% deficit has not affected government desire to create innovation-driven economy

Limiting factors:
- Entrepreneurships and management skills
- IPR and general business climate
Plenary II: Diversification Strategies

Building on the analysis of the previous section, the second plenary session proceeded to examine possible sources of future growth by addressing the potential benefits of economic diversification. Dr. Hausmann and Dr. Maloney both discussed theories of diversification as an instrument to promote growth, debated their merits and application to the regional context of ECA, and shared experiences of other developing and developed countries that have pursued similar strategies. Following this debate, ministers of selected ECA countries (Serbia and Armenia) presented their experience and the challenges they are facing in advancing respective policies, including insights to specific projects that each country is promoting in the field of innovation.
Diversification: Why and How?
Ricardo Hausmann, Director of the Center for International Development, Harvard University
ricardo_hausmann@harvard.edu

Ricardo Hausmann explained the importance of (product) diversification for economic growth. Generally speaking, rich countries are able to produce virtually everything – especially products which are complex and require different capabilities. By contrast, poor countries usually produce few, already established products which require only basic capabilities.

Complex products require a lot of very specialized skills which only rich countries can support (education, high salaries and very specialized companies). Poor countries, in turn, find it hard to develop these specialized capabilities. Nevertheless, without complex products, revenue streams are not sufficient to support education and to develop the needed capabilities. Without these skills/capabilities, again, there are no high paying products.

One solution to this dilemma is to find related products which require similar capabilities. Step by step diversification should expand existing capabilities and result in new export products. Conclusively, diversification leads to innovation which, ultimately, leads to economic growth.
A reinterpretation of the sources of growth

Why are some countries poor and others rich?

- The traditional answer emphasizes factor accumulation and "aggregate" productivity
- Countries are rich because they work with more:
  - Physical Capital (accumulated through investment)
  - Human Capital (years of schooling)
- ...and have more "total factor productivity"
- ...which lets them get more output per capita
- Policy implications:
  - More education and health
  - More savings to finance investment (and micro-finance)
  - More property rights to assure investors
  - More "productivity"
THEME 1: DIVERSIFICATION IN A POST-CRISIS WORLD

The neo-classical dead-end

- Assume the world is made out of four things
  - Output
  - Physical capital
  - Human capital
  - Labor
- 85% of growth is explained by non-of-the-above
- Total Factor Productivity = a measure of our ignorance (Abramovits, 1958)
- Maybe it is not that good a way to parse what the world is made out of

Rich countries do not just produce more per capita

They produce different products
An alternative view

- Countries differ in the variety of the capabilities they have
- Rich countries make more kinds of products and more complex products that require many capabilities
- Poor countries make simple products that reflect the few capabilities they have

The hidden structure in the comparative advantage of nations
It does not matter what level of aggregation you use.

Intuition

- Countries have capabilities
- Products require capabilities
- Countries that have more capabilities will be able to make more products
  - They would be more diversified
- Products that require more capabilities will be made by fewer countries
  - Products will be less ubiquitous
Intuition (cont’d)

- Countries that have more capabilities will be able to make products that are less ubiquitous
- Hence, countries that have more capabilities will be more diversified but will make less ubiquitous products
- Diversification of countries and ubiquity of products are negatively correlated
  - They are indirect measures of the capability set of countries

Method of Reflections: k-k', diagram

Diversification correlates with income per capita

What makes growth difficult?

- The chicken and egg problem
- You cannot make new products because you lack the capabilities
- You don’t want to accumulate the capabilities because the products that need them are not being made
  - Because of other missing capabilities
- How does the world deal with this?
- By moving towards “nearby” products
Step 1: Maximum Spanning Tree

Our Approach:
- Distance measured by probability that, if a country is good in one product, it's also good in another product.
- What is the shape of a forest? Homogenous or Heterogeneous?
- What does it look like?

Step 2: Overlay Strong Links

0.4 >
0.4 - 0.55
0.55 - 0.65
0.65 <
How do monkeys jump?
THEME 1: DIVERSIFICATION IN A POST-CRISIS WORLD

Malaysia 1975

Malaysia 1980
THEME 1: DIVERSIFICATION IN A POST-CRISIS WORLD

Malaysia 1985

Malaysia 1990
Key Implications

- Monkeys jump short distances
- So, where you are now in the product space determines where you can jump
- In the case of Malaysia, they moved to and dominated the electronics cluster
- How are the ECA countries placed in this space?

Poland (2000): very well connected & diversified (although no presence in electronics)
Russia (2000): Highly peripheral, concentrated in hydrocarbons and raw materials

The Ukraine (2000): somewhere in between - more connected than Russia, not as well connected as Poland
THEME 1: DIVERSIFICATION IN A POST-CRISIS WORLD

Summarizing this ‘connectedness’ with one number: Open Forest

Countries in Eastern Europe and Central Asia face very different opportunities
Countries with a better-connected export basket did not suffer as deep an output collapse during transition.

..and tend to be those closer to the west.

But proximity to the West has no effect on transition beyond its impact on the export mix: open forest trumps distance to Dusseldorf in a cross-country regression.
Some implications

- Why do many poor countries not catch up to rich countries?
  - Because there is no “stairway to heaven” or sequence of nearby trees that can get them to the denser parts of the product space
- What causes the “resource curse” (bad performance by resource rich countries)?
  - Poor connectedness of the resource intensive sectors
- Add value to your raw materials?
  - Forward supply linkages vs capabilities
  - Finland
- Why do countries fall into protracted slumps?
  - Because their existing export products get into trouble when they are in a part of the forest where there are no nearby trees
- Is innovation the solution?
  - It is about finding profitable excuses to accumulate capabilities that will be used for some other purpose down the road

Strategic approaches

<table>
<thead>
<tr>
<th>Ease to jump to new products: open forest</th>
<th>Space to grow in existing products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Stairway to heaven</td>
<td>Let it be</td>
</tr>
<tr>
<td>Parsimonious industrial policy</td>
<td>It ain’t broke</td>
</tr>
<tr>
<td>Help jump short distances to other products</td>
<td>Ample space to move in all directions</td>
</tr>
<tr>
<td>Bridge over troubled waters</td>
<td>Hey Jude: make it better</td>
</tr>
<tr>
<td>Strategic bets</td>
<td>Competitiveness policy</td>
</tr>
<tr>
<td>Little space to improve quality and few nearby trees</td>
<td>Improve the quality of what already exists</td>
</tr>
</tbody>
</table>
THEME 1: DIVERSIFICATION IN A POST-CRISIS WORLD

Where are the countries?

Countries in the Policy Plane

Where are the countries?

EBRD Members in the Policy Plane
Countries face different opportunities to jump to other trees

Countries with closer nearby trees grow faster
THEME 1: DIVERSIFICATION IN A POST-CRISIS WORLD

Implications

- Development is about a stepping stone process to solve the chicken and egg problem
- Much of oil and mining is too disconnected to help trigger a transformation process
  - Dedicated rail and ports
  - Few forward and backward linkages
- But there are some spillovers
  - The Steam Engine
  - Medellin gold mining and universities
- You need not jump from there
  - Adding value to your natural resource endowment is not what Norway, Australia or Chile do
  - They have other unrelated sectors

Implications

- A commitment to diversification is key
- It implies a commitment to protect the level and stability of the real exchange rate matters
  - Fiscal stabilization
  - But also a role for monetary policy
- But also a willingness of the government to address chicken and egg problems
- Especially those related to the provision of public inputs
Diversification, Innovation and Growth
William F. Maloney, Lead Economist, Development Research Group, World Bank
Wmaloney@worldbank.org

William Maloney argued that an economy, in order to grow, needs skilled workers, strong entrepreneurship, and a diversified product portfolio. According to him, three strategies for diversification, innovation and growth can be distinguished: firstly, from diversification to income (a diversified portfolio works as a damper to sector-specific trade shocks); secondly, from income to diversification (demand-driven), thirdly, comovement of diversification and income (new products embody TFP growth).

At the same time, according to Maloney, countries should continue doing things that they already do better than others. In general, rich countries produce high-risk products (possible high return), whereas poor countries generally offer low-risk products (low return). For the latter, it is hard to move to high-risk products. These countries need tools in order to reach this aim (e.g. innovative products and R&D).

Since innovation and R&D are highly correlated with the capital intensity/wealth of an economy, tools such as management/guidance, organization and support for R&D determine the economic performance of a country.
Three Issues

1. Diversification vs. innovation and growth
2. Doing what we do better
   1. Natural Resources
   2. Export Quality
3. 2 queries on thinking about the innovation environment

*Pasteur: “Chance Favors the Prepared Mind”*

ECA: Some countries likely to diversify, some not
What does this relationship mean?

1. From diversification to income:
   - Specialization leads to gains from trade (Ricardo, Krugman)
   - Diversified portfolio dampens sector specific shocks
     - Only clear negative effect from Natural Resources
   - For small countries, there must be a trade off of the two
     - Other ways of managing shocks? Sovereign wealth funds?

2. From income to diversification:
   - Taste for diversity-if opening new sectors is costly then economy will become more diverse with income.
   - Diversification an outcome of development

What does this relationship mean?

3. Co-movement of diversification and income?
   - Discovery of new goods (ideas) embodies TFP growth
   - Theoretically, no better or worse than productivity gains in existing sectors.
   - But, becomes partly an issue of innovation
Diversification as a specific innovation policy is tricky

- Diversification an outcome of difficult to predict productivity shocks/opportunities?
  - Exports very concentrated and unsystematic (Easterly et al 2009)
  - Following existing patterns not obviously helpful
    - Market saturation? Past as prologue?
- There are market failures in experimentation - discovery
  - But these appropriation externalities held in common with ongoing products as well
  - Often emerge from existing industries - Nokia
- Innovation policy
  - Be prepared to take advantage of advances in what we do
  - Be prepared to take advantage of new products
  - Mixed support products (e.g. Tekes)

Eventually, development may be about doing fewer things better

Figure 1: Diversification & Innovation

Source: Klinger and Lederman 2002
1. Natural Resources: No curse, but lots of heterogeneity in performance

- The resource curse has no statistical support:
  - Brunschweiler et al. (2008), Lederman and Maloney (2006), Sala i Martin et al. (2004).

- But need to understand heterogeneity of experiences:
  - Forestry: Dynamic in Finland, Sweden but not in many LDCs
  - Mining: Australia, California, Canada vs. Chile, Peru
  - TFP growth slower in LDCs in both agriculture and manufacturing. (Martin and Mitra 2001)
2. Export Quality: A new lens on resources and growth

- Quality measured by price (unit value)
- Huge variance within products (Schott 2004)
- Standardize: $R_{itc} = \frac{U_{itc}}{U_{i0}}$

Quality rises with development

Schott (2005) Krishna and Maloney 2010
Quality Growth: Are we converging to the quality frontier?

Figure 3: Quality Growth by Region 1990-2001

Convergence appears to be related to ability to place risky bets

Growth in Unit Value vs Standard Deviation of Growth

Krishna and Maloney 2010
This appears to be related to:

- Financial Intermediation: (credit by deposit money banks as a share of GDP)
- Innovation Effort: (R&D/GDP)
  - inability to resolve market failures/indivisibilities around innovation and R&D leads to less complex, less risky products

1. A problem of accumulation of knowledge, or of accumulation in general?

![TFP vs Capital Intensity](source: Rodriguez y Maloney (2005))
2. What type of innovation is necessary?
The national innovation system needs to be viewed very generally

Innovation
"supply"

Universities/
Think tanks/CTs
Barriers to Innovation
Market Failures (&IP)
Seed/Venture capital
Poorly articulated S&T system (including discovery, oversight)
Labor regulation
Deficient human capital

Accumulation
Capital
Knowledge

Demand Side

The firm
Barriers to Demand
Macro Context
Trade Regime
International Marketing
Externalities
Competitive Structure
Entrepreneurship

Barriers to Accumulation
Credit
Entry/Exit barriers
Business/Regulatory
Climate
Panel Discussion

Moderated by Indermit Gill, Chief Economist, ECA, World Bank
igill@worldbank.org

Bozidar Djelic, Deputy Prime Minister and Minister of Science and Technological Development, Serbia
kabinet.potpredsednika@gov.rs

Bozidar Djelic found that the successful development of a country is strongly influenced by soft factors such as ideology (determines market structure, e.g. South Korea’s path to a free-market economy), openness (determines R&D, e.g. gene technology, renewable or atomic energy), culture (gender equality, women in R&D, education), and resilience (many failures before success), and by whether a country belongs to the elite of producers (Switzerland).

According to Bozidar Djelic, successful development depends on finding ways to recruit skilled workers and to support entrepreneurs, and turning “brain drain” into “brain gain” and on not being afraid of failures.

Nerses Yeritsyan, Minister of Economy, Armenia
nyeritsyan@mineconomy.am

Nerses Yeritsyan emphasized the importance of long-term development strategies and tolerance towards failures of new ideas and towards possible capital investment failures. With regard to Armenia, he identified a lack of support measures for SMEs and of entrepreneurial spirit.

According to Yeritsyan, a development strategy should focus on identifying and supporting key entrepreneurs, of having patience on the path to success, on supporting companies to find an individual niche (not copying others) and on creating the necessary infrastructure for companies.
Plenary III: Supporting Innovative SMEs

Innovation and technology absorption in SMEs constitute an important channel of growth for Germany. To an equal extent, they are a critical channel for ECA’s post-crisis growth. Thus, selecting the right policies and instruments for public support of innovation and absorption is crucial for the economic development of ECA countries.

This session focused on public support programs in East Germany, and especially in Saxony with a view to drawing lessons for ECA. The Neue Länder (new German federal states) and the countries of the ECA region alike are confronted with the post-transition challenges of establishing an innovation-friendly investment climate and new institutions. In Germany, specific government support programs have been developed to strengthen the innovativeness of SMEs under the particular circumstances prevalent in East Germany. The session outlined such support programs of different political levels, and their impact on the innovativeness of SMEs, aiming at identifying potential lessons from the support programs in East Germany for ECA countries.
Post-Transition Technology Absorption – What Can ECA Learn from Germany?

Itzhak Goldberg, Former Advisor, ECSPF, World Bank

igoldberg@worldbank.org

Itzhak Goldberg drew lessons from Eastern Germany’s transition towards an innovation economy. According to Goldberg, innovation in a transition country can take two forms; absorbing (solutions new to the country) or inventing (solutions new to the world). Most SMEs in developing countries follow the first path, which often requires significant R&D efforts for reverse engineering (e.g. pharmaceuticals). However, transition countries are different from other developing countries in having a highly industrialized yet often outdated and in huge parts obsolete economy. Therefore, in order to prepare a fertile ground for innovative SMEs, restructuring is needed and should result in a “clean plate”. The old conglomerates should not hinder innovation.

Itzhak Goldberg suggested focusing on absorption and encouraging it through the promotion of new production processes and machinery. This requires new skills from the labor force and, ultimately, leads to higher productivity as well as an increase in innovative capacity.
What is an innovative SME – Inventing or Absorbing?

- Absorption = incremental = new-to-country but not new-to-world
- Absorption key to Japan, China and India
- R&D = pre-requisite for Absorption, not only for innovation
- Restructuring – post-transition technology absorption discontinued production line, upgrading lines (see below)

Post-crisis Growth – Whence?

- In ECA, capital is scarce and labor costly, relative to Asia; no cost-based competitiveness
- Need technology absorption to help export-oriented diversification.
- Technology Absorption Channels in SMEs:
  (i) Participate in world R&D and support firms getting into global markets
  (ii) Encourage spin offs and R&D collaboration (portability, researchers’ IPRs)
THEME 2: POLICY AND PROGRAMS OF INNOVATION AND COMMERCIALIZATION

Enterprise Perceptions: Investment Climate in Germany, Poland and Czech R.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Poland</th>
<th>East Germany</th>
<th>West Germany</th>
<th>Czech Rep.</th>
<th>Spain</th>
<th>South Korea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tax rates</td>
<td>59.0</td>
<td>35.8</td>
<td>26.6</td>
<td>60.7</td>
<td>550</td>
<td>536</td>
</tr>
<tr>
<td>Regulatory uncertainty</td>
<td>43.1</td>
<td>8.5</td>
<td>5.0</td>
<td>21.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of financing</td>
<td>45.8</td>
<td>29.8</td>
<td>13.2</td>
<td>18.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macroeconomic instability</td>
<td>39.9</td>
<td>21.9</td>
<td>11.6</td>
<td>18.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tax administration</td>
<td>38.3</td>
<td>30.1</td>
<td>20.1</td>
<td>52.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access to financing</td>
<td>35.3</td>
<td>28.6</td>
<td>10.3</td>
<td>18.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Functioning of judiciary</td>
<td>21.9</td>
<td>6.2</td>
<td>.6</td>
<td>25.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: WB Enterprise Surveys

Technology Absorption – Enterprise Surveys
Indicators – Germany, Poland and Czech R.

<table>
<thead>
<tr>
<th>Initiatives of company over the last 36 months [%]</th>
<th>% of firms that have undertaken the initiative within country</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Poland</td>
</tr>
<tr>
<td>Added new product</td>
<td>34.7</td>
</tr>
<tr>
<td>Upgraded existing product</td>
<td>49.0</td>
</tr>
<tr>
<td>Discontinued product line</td>
<td>11.5</td>
</tr>
<tr>
<td>Obtained ISO</td>
<td>12.4</td>
</tr>
</tbody>
</table>

Source: WB Enterprise Surveys
Do we know how to support absorption rather than innovation?

- In principle, we know why/how to subsidize innovation. But...
- Why subsidize technology absorption?
- Matching grants: OK for licensing, export promotion, consultancy. But...
- Most absorption is via new machinery and equipment – do we subsidize capital assets?
- or the R&D / skills needed to properly adapt technology and workforce to new tech?

Public Support for Innovation – and what can ECA learn from Germany?

- **Matching Grants** for R&D in enterprises and support for Venture Capital (VC) -- successful in the US (SBIR, ...), Finland (TEKES, ...), Israel (OCS/Yozma)
- Grants
  - mixed results in Poland,
  - successful in Croatia
  - successful but miniscule in Russia (Bortnik)
- State support for VC
  - problematic in Russia
    (RVK – no pipeline)
  - problematic in Croatia
    (VC no pipeline)
  - problematic in Poland (only large)
- And today we will hear from High-Tech Gründerfonds in Germany whether this model is working
What can ECA learn from Germany – Questions to Panelists

- How did the investment climate in East Germany change post-unification?
- How do you support new firm creation in E. Germany?
- Do you manage to attract W. German firms to set up operations and/or R&D. And if not why not?
- What is your innovation strategy e.g. did you improve cooperation between research and industry Innovation Assistant Program to promote in-house firm R&D?
- What financial instruments do you use: loans or grants? Do you believe that loans encourage risk-taking in innovation?
Engelbert Beyer introduced the program “Entrepreneurial Regions” as part of the German High-Tech Strategy. With the High-Tech Strategy, the German government has, for the first time, formulated a national strategy for innovation policy. Clusters and the combination of competencies constitute one of the Strategy’s focal points. The program “Entrepreneurial Regions” includes a toolbox tailored towards the regional peculiarities of the New Länder. Over the course of the past two decades, East Germany’s research landscape has become competitive. Moving forward, one of the most important aspects will be a greater degree of flexibility in terms of research initiatives.
THEME 2: POLICY AND PROGRAMS OF INNOVATION AND COMMERCIALIZATION

The High-Tech Strategy for Germany

- For the first time a national strategy for innovation policy
- Specific strategies for individual fields of technology and application: analysis – definition of aim – joint action
- Concrete cross-section activities for an improved cooperation between research and industry
- Innovation-friendly framework conditions for a positive innovation culture
- Innovation policy with great stamina


Innovation policy in Germany is more and more linked to cluster and network concepts!
Initial Situation in the New German Länder

Structural Problems and Deficits in the New Länder

- Still gap in value creation in comparison to the Old Länder
- Lack of jobs and opportunities for vocational training
- Migration to the Old Länder as well as low birth rate
- Few large-scale enterprises with own research department
- Many small and very small enterprises with low equity ratio
- High barriers to market entry for new products

Principles of an Innovation Policy

- Innovation policy must have the whole innovation process in mind and systematically offer suitable instruments.
- Innovation policy therefore has to be strategically designed and reliable for the actors of the process.
- Innovation support must focus on outstanding innovation potentials ("strengths", "unique features").
- Innovation support has to link research and development to a clear exploitation concept from the outset.
- Innovation support must encourage people’s own initiative and responsibility.
Support Principles of Unternehmen Region – 1

- The BMBF supports existing strengths and potentials of a region, which are usually based on a special technological competence.
- A regional alliance commanding such specific strengths has to develop a strategy aimed at boosting this core competence and at making it a success in the market.
- The regional alliances form in a bottom-up process. This means that no regions, actors, industries or technologies are designated for support beforehand.

Support Principles of Unternehmen Region – 2

- Quality, competence, strategy and the analysed market potential are decisive for support.
- The support funds of the BMBF serve as start-up capital and investments for regional alliances acting with entrepreneurial vision.
- Unternehmen Region uses all available support instruments (project support R&D, education, surveys, consulting etc.).
Cluster-oriented BMBF Innovation Support for the New German Länder: Unternehmen Region

Innovations for economic growth in the region

Unternehmen Region – The Programmes

Innovative regionale Wachstumskerne / WK Potenzial

Zentren für Innovationskompetenz

InnoProfile

ForMaT

Innovationsforen

5 support programmes, …
... that have predominantly developed from InnoRegio (1999-2006).
... which all have one goal: to establish and consolidate a unique technological competence of a region and develop it into innovations that lead to more growth in the region.
... which spur the creation of regional economic and scientific clusters in the New German Länder.
... which invest initial capital into regional alliances that think, plan and act in a business-like manner.
... which are closely related to each other and each support initiatives at a different stage of the innovation process.
THEME 2: POLICY AND PROGRAMS OF INNOVATION AND COMMERZIALIZATION

Unternehmen Region – The Programme Family

Five support programmes:
- which all have one goal: to establish and consolidate a unique technological competence of a region and develop it into innovations that lead to more growth in the region.
- which spur the creation of regional economic and scientific clusters in the New German Länder.
- which invest initial capital into regional alliances that think, plan and act in a business-like manner.
- which are closely related to each other and each support initiatives at a different stage of the innovation process.

- Strengthening market-oriented regional alliances with a unique joint platform technology and realisable market potential.
  Start: 2001
  Initiative: 313 (3 yrs.)
  Budget: EUR 199 until 2012

- Supporting the creation and strategic reorientation of regional innovation networks through Innovation Forums.
  Start: 2001
  Initiative: 104
  Budget: EUR 8.8 m

- Establishing excellent and internationally competitive research centres which possess innovation competence and are highly attractive for young scientists.
  Start: 2002
  Initiative: 3rd round: 2nd round: 1st round: 6 + 120K - 8 - 8
  Budget: EUR 220 m until 2016

- Supporting junior research groups at universities and research institutions which gear their work towards specific innovation-related problems of the SMEs in their region.
  Start: 2005
  1st round: 18 initiatives
  2nd round: 14 initiatives
  3rd round: 10 initiatives
  Duration: 5 years
  Budget: EUR 140 m until 2013

- Improving the economic usability of research findings at universities and research institutions in two phases.
  Start: 2007
  Phase I: 80 consortia teams
  Phase II: 24 innovation labs
  Budget: EUR 50 m until 2012
Experiences with the Innovation Assistant Program 1995 – 2008
Peter Nothnagel, Head of Division, Saxon State Ministry for Economic Affairs; Labour and Transport, Germany
peter.nothnagel@smwa.sachsen.de

Peter Nothnagel introduced the “Innovation Assistant Program”. Compared with the diversification of its industry, Saxony exhibits a low degree of researchers in commercial companies. To increase the number of researchers and to support SMEs in developing their own research capacity, the program subsidizes the employment of recent graduates. Success factors of the program are a company-centered information program, clearly defined goals, a well working program administration and evaluation.
1. Framework

- Unemployment rate: 13.4% (03/2010)
- GDP: 92.9 billions € (2009)
- R&D expenditures of industry: 901.5 mill. € (in 2005)
- Number of SME in region: approx. 148,100 (99.88% of companies) (2008)

1. Framework

- GDP: 92.9 billions € (2009)
- R&D expenditures of industry: 901.5 mill. € (in 2005)
- Number of SME in region: approx. 148,100 (99.88%) (2008)
- R&D infrastructure: 5 universities, 5 technical colleges, 15 Fraunhofer-institutes/ institutions, 6 Max-Planck-Institutes, 6 Leibniz-Institutes, 2 Helmholtz-Institutes, 12 non-profit research enterprises, 42 TT-centers + incubators
- Number of students: 109,213 (winter semester 2009/2010)
Basic economic facts

Economic growth: - 5.7% Saxony (2008 - 2009)
(real growth of the GDP) Ø - 4.5%
East Germany, Ø - 6.8% Germany

Job density: jobs / thousand inhabitants,
Ø 441 East Germany,
Ø 491 Germany,
Ø 501 old Länder without Berlin
Ø 462 Saxony

Unemployment:
Feb. 2010: 13.6% (Ø 2009: 12.9%)
City of Dresden: 12.5%
City of Leipzig: 14.8%
13.7% East Germany
8.7% Germany

Industrial R&D-staff: ca. 45.1% of new Länder without Berlin (2009)

High-tech competence centers in Saxony
The Problem:
- 1) SME dominated economy
  2) a lot of small and medium-sized companies without (or with insufficient) own R&D-capacities
  3) lack of technology transfer into these companies
  4) on the other hand: large number of (technical) students/year

The Reason:
- Market failure: young graduates are quite well educated and have good chances all over Germany and Europe. Wages in Saxony are lower than in western parts of Germany. A lot of young high-potentials leave Saxony after education.

The Consequence (of course besides other initiatives):
- Initiative to stimulate SME to hire young graduates (designed by the SMWA in 1995) to overcome market failure
2. Brief description of the instrument

- Support for the employment of graduates esp. from universities and technical colleges in small or medium-sized companies without or with insufficient R&D potentials
- Minimum duration of employment: 1 year (max. 2 years)
- Assistant - has to have "fresh knowledge" (last degree < 1 year)
- Assistant - not a relative of the company-owner
- Assistant - not already an employee of the company
- More than 2 assistants per enterprise can only be supported, if
  - the previous assistants have got permanent jobs in the enterprises,
  - at least two further jobs (per supported innovation) assistant were created in the production departments of the enterprise,
  - the proportion of R&D staff in the company is less than 30 %

The most important measures:

- Support for the employment is linked to the realisation of innovations and technology oriented projects (funded or non-funded)
- Grant of up to 50% of assistant's gross salary
- Limit of eligible costs (approx. 2800 €/month - corresponding to the current agreement on tariffs in the public sector)
The instrument is mainly aimed at:

- strengthening the economic competitiveness of small and medium-sized companies
- increasing the R&D activity of these companies
- improving the reception capacities of these companies → enable supported firms to realise joint projects with research institutes
- strengthening university - industry- links
- supporting technology transfer from universities and technical colleges
- helping to create highly qualified sustainable jobs
- contributing to diminish regional brain drain - tool against the demographic problem in Saxony

Initiator:
Saxony State Ministry for Economic Affairs, Labour and Transport - SMWA (www.smwa.sachsen.de)
(today in responsibility of SMWK - www.smwk.sachsen.de)

Implementer:
SAB The Development Bank of Saxony (www.sab.sachsen.de)

Partner:
- Commercial enterprises (as beneficiaries)
- Chambers of Commerce and Industry, Chambers of Crafts
3. Impact/ results

Number of supported innovation assistants 641
Project costs appr. 51 Mill. €
Grants appr. 22 Mill. €
New jobs 1,697

Qualitative
- Efficient instrument: good grant per 2 years/job ratio:
  appr.: 34 300 €/assistant (approx. 13 000 €/new job (including add. staff)
- Strengthening the innovation force of the companies
- High percentage of satisfaction of employers with „their“ assistants (87 %)


Size distribution of supported companies (1995-2007)
4. Success factors

1. Bringing the information about the program to the companies (PR, SMWA, Chambers of Commerce, ...)

2. Motivating partners in the universities (transfer agencies and/or experienced people that inform students and promote the program) - own interest should be to get company-contacts for later projects

3. Continuity in the program-availability and -administration

4. Simple and transparent application procedure and treatment

5. Possibility for hire/test/fire or long-term-partnership for both sides
5. Actual modifications of the instrument (January 2010, SMWK)

- Longer duration of funded employment possible: up to 3 years
- Higher limit of eligible costs (up to 50 k€/year*)
- Grant of up to 50% of assistant’s gross salary in the first 2 years and up to 25% in the 3rd year
- **In Addition**: Innovation assistant (IA) is allowed to come from a non-SME or an institute for a limited period to an SME ("borrow an IA"). He has to be an experienced expert (minimum 5 years or doctoral degree) and gets a guarantee for the possibility to come back in the original company. In this case the maximum of eligible costs is 80 k€/year.* (Grant of up to 50% for 3 years) [Ratio (by numbers) of funded IA : "normal" employees <= 1:50]
Financial Instruments in Support of Innovation
Rainer Staudt, Head of Unit, Regional Development Bank of Saxony (SAB)
janine.lamprecht@sab.sachsen.de

Rainer Staudt introduced the work of the SAB (Development Bank of Saxony, Sächsische Aufbaubank).
The SAB is active in the areas of environment and agriculture, infrastructure and urban development, housing support, business and technology promotion, as well as with the European Social Fund. It offers direct consultancy services for SMEs, gives grants, arranges public loans and guarantees, and it provides access to (public) venture capital.
Promotion of the Innovation Process in Saxony

<table>
<thead>
<tr>
<th>Stage</th>
<th>SME</th>
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<tbody>
<tr>
<td>Industrial Research and Development</td>
<td></td>
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<tr>
<td>- R &amp; D projects in individual enterprises</td>
<td></td>
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<tr>
<td>- R &amp; D joint projects</td>
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<tr>
<td>- Technology transfer</td>
<td>X</td>
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<tr>
<td>- Innovation assistant</td>
<td>X</td>
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<tr>
<td>Start-up Programme</td>
<td></td>
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<tr>
<td>- Business plan competition Saxony</td>
<td>o</td>
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<tr>
<td>- Initiatives for start-ups</td>
<td>o</td>
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<tr>
<td>- Scholarships</td>
<td>o</td>
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<tr>
<td>- Coaching</td>
<td>o</td>
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<tr>
<td>- Technology and start-up funds</td>
<td>o</td>
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<tr>
<td>Production Process</td>
<td></td>
</tr>
<tr>
<td>- Promotion of investments (grants, loans)</td>
<td>X</td>
</tr>
<tr>
<td>- Promotion of SME by grants (e.g. participation at fairs)</td>
<td>X</td>
</tr>
<tr>
<td>- Market launch of innovative products</td>
<td>X</td>
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<tr>
<td>- Start-up and growth financing programme</td>
<td>X</td>
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</tbody>
</table>

X exclusively

Lessons learnt from the crisis

- Crisis especially noticeable in large enterprises and in certain sectors
- Advantageous economic structure with smaller enterprises in Saxony
- Stronger use of R & D programmes
- Innovative companies find better solutions to cope with this crisis
Financing Innovation
Roland Siller, First Vice President for ECA, KfW Development Bank

Roland Siller introduced the KfW Development Bank as a public institution for the financial support of SMEs and as financier of innovations. The KfW has a broad scope, supporting high-tech and innovation-based as well as traditional companies.
THEME 2: POLICY AND PROGRAMS OF INNOVATION AND COMMERCIALIZATION

60 Years of KfW
Financing with a Public Mission

- Promotional bank of the Federal Republic of Germany
- Founded in 1948 as public law institution Kreditanstalt für Wiederaufbau (KfW)
- Shareholders: 80% Federal Republic, 20% federal states
- Headquarters: Frankfurt am Main
  Branches: Berlin and Bonn
- Balance sheet (2009): EUR 400 billion
- Representative offices: about 60 offices and representations worldwide
- No of employees: 4,265
- Best rating: AAA/Aaa/AAA

A Bank with a Wide Array of Roles and Functions
THEME 2: POLICY AND PROGRAMS OF INNOVATION AND COMMERCIALIZATION

Approach and Volume of Innovation Financing in Germany
Role of KfW Mittelstandsbank

1) Concept

2) Instruments

3) Volumes

Adaptation of KfW Innovation Finance Programmes to the Russian Federation

Status quo in the Russian Federation:
- Innovation definition focuses on hi-tech and global innovation concepts
- Existing promotion programmes follow that approach (hardly bankable), no SME focus

Aims of corporation between Vnesheconombank and KfW Development Bank:
- Fostering innovation on SME level
- Strengthening the Russian banking sector in terms of know-how and programmes
- Implementing a 100 mn EUR programme for Russian banks to be orient to SME

Approach of KfW Development Bank:
- Adaptation of existing programmes to Russia; utilization of experiences in Germany
- Support in the development and anchorage of a broader innovation definition including innovative modernisation (high demand potential in Russia; bankable products possible)
- Establishment of cooperation with development institutions like Vnesheconombank and RosBR
- On-lending via eligible partner banks for risk sharing and faster market penetration (KfW-Model)
- Focus on SME as a sector with the most promising growth potential
- Step by step approach: loan based programme followed by equity and mezzanine programmes

!! Sustainable success of the programme more important than quick wins !!
THEME 2: POLICY AND PROGRAMS OF INNOVATION AND COMMERCIALIZATION

Overview: Financial and Private Sector Development
Europe&Caucasus
Activities and Portfolio

Activities
- Financing / Refinancing of SME and Microbanks in the regions
- Greenfielding of 13 banks
- Establishment of best practice structured finance projects such as the EFSE
  - (European Fund for South East Europe; biggest microfinance fund worldwide:
    - >700 mln EUR in assets; <600 mln EUR loan portfolio);
    - 113,000 clients, 200,000 loans disburied
    - benchmark for public-private partnership projects

Instruments
- Senior loans
- Subordinated loans
- Equity participations
- Risk participations, guarantees
- Technical assistance

Countries
- Southeast Europe: Serbia, Montenegro, Kosovo, Bosnia & Herzegovina, Albania
- EU Accession Countries: Croatia, Macedonia, Turkey, Bulgaria (EU), Romania (EU)
- Eastern Europe: Russia, Ukraine, Moldova
- Caucasus: Georgia, Armenia, Azerbaijan

Portfolio
- 3 billion EUR (as of April 2010)
  - of which 2.4 billion EUR are channelled through the financial sector
    (mainly for SME promotion purposes)

EFSE – Innovative Structure
Adaptation of Fund Structure for advanced Innovation
Finance (Mezzanine, Equity)

Leverage of funds: EFSE pursues a Tiered Funding Strategy

<table>
<thead>
<tr>
<th>Private Investors</th>
<th>Fund Volume in EUR million</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-Shares and Notes</td>
<td>Dec 05</td>
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<tr>
<td>Senior Notes</td>
<td>20</td>
</tr>
<tr>
<td>B-Shares</td>
<td>60</td>
</tr>
<tr>
<td>Mezzanine Finance</td>
<td>Dec 05</td>
</tr>
<tr>
<td>C-Shares</td>
<td>66</td>
</tr>
<tr>
<td>Donor Funds</td>
<td>148</td>
</tr>
</tbody>
</table>
Dr. Posselt presented several key insights of an evaluation of innovation support programs. According to Posselt, support programs have to be embedded in the respective national innovation system in order to ensure their consistency. Their design, monitoring and evaluation are of high importance. Program concepts and ideas have to be adapted to local circumstances. Since the capacity of human resources is limited, their development should be part of any program.
Key messages

Support programs are embedded in the National Innovation System

Design, monitoring, and evaluation of programs are important tasks

Program concepts and ideas need to be adopted to countries

Example of German institutions within the National Innovation System
Design, monitoring, and evaluation of programs

- Pitfall 1: Built consistency and fit within the Innovation System
- Pitfall 2: Pay attention to the development of Human Resources
- Pitfall 3: Be aware of transfer and commercialization
- Pitfall 4: Take into account the benefits of firms and markets

Pitfall 1: Built consistency and fit within the Innovation System

- How do National Innovation Systems work?
- What is the impact of support programs for regional development?
- How to support the existing economic structures by the development of R&D structures?

Example from the US

- Small Business Innovation Research (SBIR) Program enacted in 1982
  - Awardees are exclusively US-owned small businesses
  - Small Business Administration changed interpretation of law and excluded venture capitalist financed firms from public support

Consistency from program design to implementation and final calculation of effects!
Pitfall 2: Pay attention to the development of Human Resources

- How to align education systems with the needs of economy?
- Which instruments for the promotion of cooperative relationships between industry and education are available and applied in practice?

Example from Malaysia
- BioValley was intended to nurture local research and medical discoveries and enhance commercialization
- Lack of properly trained individuals
- Need for understanding the entrepreneurial market
- => „Valley of Bio-Ghosts”

Alignment of educational system towards private sector needs!

Pitfall 3: Be aware of transfer and commercialization

- How to manage and improve the knowledge and technology transfer between science and economy as well as regions and countries (institutions and processes)?

Example from the UK
- Funds for biotechnology came from state-run National Enterprise Board
- IPR: Celltech received the right to refuse licences inventions => other (UK) biotech firms were unable to licence technology created with public money
- => Focus on science => little commercialization after 10 years

Commercialization and transfer strategies of public funded research are needed!
Pitfall 4: Take into account the benefits of firms and markets

- How to closely follow the development of companies and SMEs under particular support programs?
- How to strengthen the benefits for SMEs by support programs?
- How to design support programs for SMEs to increase their ability to operate internationally?
- How to increase the competitiveness of SMEs?

Example from EU

- Insufficiently small funds => Problem: small financial support – no impact
- Excessively large programs => Problem: crowding out

Estimation of investments, impacts and leverage effects is needed!

Transferability of support programs – Hypotheses

1. **Design and fit**: Programs need to be designed carefully based on experience and they need to be consistent with the characteristics of the National Innovation System of a country! No easy transfer! Long experience embedded in program design.

2. **Evaluation**: Monitoring, ex post evaluation and learning processes are necessary to continuously evolve and improve a program!

3. **Long-run success**: Proper design and continuous evaluation are an extra effort that pay in the long run!
Fraunhofer Center for Central and Eastern Europe (Fraunhofer MOEZ)

Applied Research in International Context:

■ Innovation Systems and Value Creation
■ Research and Education Systems
■ Innovative Transfer Systems
■ Companies and International Markets

■ Prof. Dr. Thorsten Posselt; thorsten.posselt@moez.fraunhofer.de
■ Fraunhofer Center for Central and Eastern Europe
Creating Sustainable Businesses in the Knowledge Economy
Tim Kelly, Lead ICT Policy Specialist InfoDev, World Bank
tkelly@worldbank.org

Tim Kelly introduced the InfoDev program and the World Bank implementation of the business incubator concept. According to Kelly, the three Baltic States and Poland are making great progress in these areas. The role of the World Bank includes providing technical support and grants in establishing the necessary ecosystems. Currently, a new US$20M project including three Eastern European countries is being initiated.
Creating Sustainable Businesses in the Knowledge Economy

• A public-private partnership, launched on Dec 17 2009
  – Ministry of Foreign Affairs, Finland
  – infoDev / World Bank
  – Nokia
    • Other partners include Mobile Monday,
      Korea ICT4D Fund, Ministries

• Three key areas of focus
  – Agribusiness
  – Mobile communications
  – Innovation, SME creation and
    supporting technology entrepreneurs

• Three regions
  – Africa
  – Asia
  – Eastern Europe, Caucasus and Central Asia (ECA)

infoDev’s regional business incubation networks:
Promoting the start-up and growth of technology SMEs

300+ incubators and 20,000 SMEs in over 80 developing countries

Sectoral Focus

- Textile: 6%
- Agriculture: 20%
- Biotech: 3%
- Clean Tech: 4%
- ICT: 46%
- Manufacturing: 22%

Social Inclusion Targets

- Youth: 36%
- Women: 24%
- Rural Poor: 20%
- Urban Poor: 20%

www.infodev.org
ECA Program Summary: 2010-12

1. Establishing an ECA regional mobile applications lab
2. Extending mobile apps by working with Mobile Monday to establish mobile social networking hubs
5. Create, scale an internationalize SMEs in ECA
   a) Scaling business incubators and strengthening the Innovation and entrepreneurship eco-system in 3 Countries
   b) ECAbit projects on SME financing and impact assessment
7. Enhancing the competitiveness of broadband networks
8. Regulatory capacity building on broadband and mobile applications

ECA 1+2: Mobile Applications
Assisting Mobile Applications Entrepreneurs to Start and Scale their Businesses

- Regional service hub for ECA
- Delivered in collaboration with Nokia, leveraging an existing organization in the host country
- Service offering to include:
  - Training and Testing facilities
  - Identification and piloting of potential applications
  - Incubation of start-ups
  - Business and financial services
  - Linkages with operators
- Entrepreneurs to be “recruited” through incubation network and mobile social networks

10 new applications launched with viable business models by 2012
Why Mobile Applications?

- High growth market in a high growth sector
- Relatively low barriers to entry, esp for localization
- Strong possibilities for SME internationalization

ECA 3: Business Incubation

Business incubators worldwide: ~4'000
ECA estimate: ~200-300

Country examples:
- Romania: 20 incubators, started in 1992-1994, donor support
- Russia: 120 incubators (estimate), started in 1995 by donors, new government-supported program started in 2005
- Belarus: 8 incubators, started in 1998
- Azerbaijan: 1 incubator in planning stage, university based with donor support

“Officially, there are 70 incubators operating in our country, but in practice there are 12.” (Incubator manager, ECA)
ECA Business Incubator success stories (1)

Kharpcheloproduct Ltd. Kharkov

- Incubatee of Kharkov Technologies Incubator, Ukraine.
- Honey and wax producer, honey and wax production instruments producer. Aircraft technologies engineer by profession.
- 2004: Four employees, focus on local market.
- Incubation impact (*incubatee perspective*): IT application and international marketing.
- 20 full and 40 seasonal employees in 2007.
- Sales increased 40-fold.
- Network of 100 local honey producers.

*For more details on this and other success stories, go to www.idisc.net.*

ECA Business Incubator success stories (2)

42Gradusi

- Incubatee of BII.GE Business Incubator Initiative Tbilisi (Georgia)
- Software development (B2B sector)
- Clients in Georgia and Germany.
- Incubation impact (*incubatee perspective*): Vision and strategy development, management, contacts to clients.

*For more details on this and other success stories, go to www.idisc.net.*
ECA 3a: Scaling Business Incubators and Strengthening Innovation Eco-Systems

Rationale:
- Increased impact can be achieved through larger scale
- An eco-system is required to effectively enable start-up of technology enterprises

Program:
- 3 countries from Eastern Europe, Caucasus and Central Asia
- 2-year program of technical assistance and grant financing

ECA 3b: Impact Assessment of Business Incubators

Key questions:
- What are the growth rates of incubated enterprises after they leave the incubator?
- What size have the enterprises reached in terms of sales and employees?
- How many of them have an innovative product, service or business model?
- What is the effect of the incubated companies on the overall innovation eco-system and the competitiveness of a particular city, region or sector?
- Is the incubator sustainable? How is it financed?
- What lessons can be derived?
ECA 4+5. Enhancing Competitiveness and providing capacity-building

The problem:
- Generally low-levels of international
- internet bandwidth
- This results in high-priced broadband services and poor quality networks
- Network architectures reflect historical links

Towards a solution:
- Increase the level of competition and choice in international bandwidth
- Ensure cost savings are reflected in lower prices to end-users
- Research the connectivity requirements of SMEs
- Provide tailored capacity-building and awareness raising for regulators

International Bandwidth per user in selected ECA countries, 2008

Source: TeleGeography/ITU.

Enabling Value Added Agribusiness Entrepreneurship

Objective: Increasing access to know-how markets through mobile applications
- Enabling innovative, value added business growth through business incubation
- Global community of practice on agribusiness incubation
- Agribusiness incubation good practice assessment and training for incubator managers
- Good practice handbooks on leveraging ICT and innovation in agriculture
Expanding Market Access for Technology SMEs

Why expand internationally?
• Domestic markets are often small and limit opportunities for growth
• International expansion extends the benefits of new technologies to a larger population

What hinders international expansion?
• Cost
• Lack of market linkages abroad
• Limited know-how on:
  • international market conditions,
  • business practices,
  • tools for internationalization,
  • regulatory requirements

3. Building Capacity in Business Incubation

A state-of-the-art training program designed for business incubation stakeholders in developing countries and emerging economies

- Business Incubation Models
- Planning an Incubator
- Marketing and Stakeholder Management
- Financial Aspects of an Incubator
- Facilitating Access to Finance for Incubatees
- Developing a Mentoring Program
- Monitoring and Evaluation for Business Incubators
- Business Incubation and Technology Commercialization
- Virtual Business Incubation
THEME 2: POLICY AND PROGRAMS OF INNOVATION AND COMMERCIALIZATION

The SME Internationalization Program
Leveraging infoDev’s global network to help technology SMEs gain access to foreign markets

ECA Business Incubator success stories (3)

MHSWARE

- Incubatee of Timisoara Software Incubator, Romania.
- Computer system design, hardware and software development.
- Founded in 2004 by three university graduates.
- Incubation impact (incubatee perspective): “One of the most important benefits is the possibility to work within a community of similar and like-minded start-up companies.”
- In 2010, serving clients in Romania, Italy, Switzerland, Canada, Germany.

For more details on this and other success stories, go to www.idisc.net.
ECA Business Incubator success stories (4)

Incubation success stories (IV)

AdvertSMS
- Incubatee of YES Incubator Skopje, FY Macedonia
- Mobile application based marketing services.
- Founded in 2008 by a 21 years old student.
- From university business plan competition to market.
- Incubation impact (incubatee perspective): Networking, knowledge and infrastructure.
- Reached break-even after one year of incubation.
- In 2010, market innovator and leader in the country.

For more details on this success story and on more success stories, please visit www.idisc.net.

infoDev’s Program Offering

<table>
<thead>
<tr>
<th>Country</th>
<th>Regional</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>For incubators and technology parks and their stakeholders:</td>
<td>For incubators and technology parks: Regional networks and knowledge exchange. Training.</td>
<td>For incubation and IT Park professionals and policymakers: - Good practices, models - Toolkits - Monitoring and evaluation tools and analysis - South-south working groups - Bi-annual Global Forum for all stakeholders</td>
</tr>
<tr>
<td>Tailored package of services including: seed &amp; innovation funding</td>
<td>For policymakers:</td>
<td>Competitive</td>
</tr>
<tr>
<td>capacity building</td>
<td>Regional roundtables and awareness raising</td>
<td>SMEs</td>
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<tr>
<td>feasibility and replication</td>
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<td>Jobs</td>
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<tr>
<td>assistance with strengthening the national eco-system</td>
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<td>Innovations</td>
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<td>Empowerment</td>
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<td>Sustainable development</td>
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New:
Internationalization and access to finance for technology entrepreneurs
Expansion to climate technology and value added agribusiness
Trends in Our Network

- 75 percent of graduated enterprises survive for at least 3 years following graduation
- Upon graduation, the enterprises have on average 10-15 employees and USD 200,000 in annual turnover
- More than 50 percent are public-private partnerships
- Business incubation is cost effective when it:
  - targets high growth potential enterprises
  - is designed on the basis of a proper market assessment
  - is run with a business mindset
  - assumes a brokering role in the innovation and entrepreneurship eco-system
  - focuses on business incubation as a process – not a building
- Donors are expecting incubators to reach financial sustainability – it is doable...
THEME 2: POLICY AND PROGRAMS OF INNOVATION AND COMMERCIALIZATION

Plenary IV: Commercialization of Public R&D

The number of spinoff companies and technologies that have been patented and subsequently licensed as a result of public R&D in ECA is still very low by international standards. Similarly, the private sector allocates very little of its own R&D funding to research undertaken by public universities or research institutes in the region. By fostering the commercialization of public research, governments would increase the impact of innovation on economic growth.

This plenary session discussed strategies fostering the commercialization of public research in ECA. Do ECA countries need a Bayh-Dole Act type of legislation? Why are technology transfer offices still rare in the region? Are countries over-investing in science parks? What is the role that venture capital should play? These were some of the questions addressed in the session.
Enabling Intellectual Property Regimes
Mario Cervantes, Senior Economist Science and Technology Policy Division, OECD
Mario.Cervantes@oecd.org

Mario Cervantes introduced the U.S. Bayh-Dole Act (University and Small Business Patent Procedures Act) and its concept of academic patenting.
The Bayh-Dole Act gives research institutions the right to patent and to commercially use the results of publicly funded research projects. The motivation for this act was to increase the accountability of publicly financed research and the commercial use of research results.

In the beginning, there were fears that academic patenting would lead to an erosion of basic research; however, most patents are issued in fundamental research very early in the development process. Overall, only very few patents generate meaningful revenue streams. The most important measures of success are the number of patents granted and the accompanying revenue streams.
Today’s Themes

(1) Bayh-Dole or Academic Patenting as Policy
(2) Concerns about academic patenting
(3) Commercialisation of public R&D in a networked innovation model
(4) Towards knowledge networks and markets: collaborative IP mechanisms
(5) Implications for Policy

Academic Patenting as Policy

Rationale:
Revised social contract between science and society: greater calls for accountability
Market failures limit social-economic benefits from public research
Redistribute returns from public research back to society
Before Bayh-Dole
- 1920-1970s Ad hoc petition to patent by US universities
- 1970s- Institutional agreements between Federal Agencies/Departments & Universities
- Informal channels for commercialising academic research
- Returns from public research accrue to private agents
“Success” breeds emulation in OECD and beyond

- Reforms to funding rules in Germany, Japan, Korea
- Abolishment of professor’s privilege in Denmark, Germany Austria, Norway
- Emulation of Bayh-Dole in emerging economies: Brazil, China, India, Malaysia and South Africa

Academic Patenting as Policy (con’t)

- What is measure of success?
  - Patents and Licenses
  - Royalty Revenue
  - New Products
  - Spin-off companies
  - High skill jobs
  - Productivity and Growth
Evidence largely supportive, based on US/OECD experience

- Patent grants to universities and colleges increased sharply from 1988 to about 1999, when they peaked at just under 3,700 patents, and then fell to about 3,000 in 2008 (USPTO).
- Data from AUTM show that invention disclosures filed with university technology management offices grew from 13,700 in 2003 to 17,700 in 2007.
- Patent applications filed by reporting universities and colleges increased from 7,200 in 2003 to almost 11,000 in 2007.
- US universities income from licensing increased from $200 million in 1991 to 1.6 billion US$ in 2005.

- World-wide, public institutions owned 6% of all international patents filed under the PCT between 2003 and 2005.
- In Singapore, 24% of all PCT filings were owned either by the government or the higher education sector (OECD, based on PCT data).
- In Europe OECD, Ireland had the highest proportion of patenting by universities (9.5% in 2003-05), a notable increase over the mid-1990s when universities owned less than 3%.
- In Belgium, Israel, Spain, the United Kingdom and the United States, the higher education sector accounts for 6 to 9% of all PCT filings.
The problem with success

- Need markets for technology
- Need entrepreneurial academics (spin-offs)
- Need tacit knowledge
- Need institutional structures that give TTOs independence and credibility vis-a-vis academia and industry
- Need management and financial skills
- Need seed funding and links to venture funding
- Need luck - success is highly skewed
- Need to consider other output/outcome measures (e.g. networks, behavioural change)

Concerns about Academic Patenting

1. Concerns with patents in general - scope, quality, patent strategy (to exploit, to defend), fragmentation of IP rights (anti-commons)
2. Concerns about the mission of universities - shift from basic to applied, impact on academic freedom, conflicts of interest, costs and benefits
3. Concerns about academic patents in particular - will they aggravate the shift? Will they block research? Will they stifle other forms of knowledge transfer? Exclusive vs. non-exclusive licenses
Concerns valid, but jury is still out

- Anecdotal evidence of a growth in secrecy and limits on disclosure
- Universities are patenting inputs to research that were previously released in public domain
- BUT, there has not been a dramatic re-orientation from basic to applied
- Most academic licenses involve embryonic inventions, and require further R&D downstream
- Design and dissemination of policy safeguards can help

Examples of policy safeguards

- 1) NIH guidelines in 1999 encouraging grant recipients to widely disseminate NIH-Funded “Research Tools” so as to avoid blocking upstream research (e.g. in diagnostics).

- The underlying principles of the NIH guidelines on research tools have been emulated by funding agencies in other countries

- 2) 2004 Rules of the California Institute of Regenerative Medicine (CIRM) requires that “non-profit grantees shall negotiate non-exclusive licenses on CIRM-funded inventions whenever possible”
The challenge of the networked innovation model

Bayh-Dole enacted at a time of crises, when Japan was the main competitor to the US. Today it’s a bigger game.

Bayh-Dole enacted when a supply-push tech-transfer model predominate; when a single or few patents on inventions could launch entire industries

Today, turning science into business is much more complex: a focus on challenge driven research, joint development

Need for speed, cost-sharing, and access to best talent and knowledge anywhere in the world = more openness!
Towards knowledge networks and markets: collaborative IP mechanisms

Networked innovation models requires greater sharing of knowledge and collaboration

Use of collaborative IP mechanisms such as Patent Pools, IP clearing houses, IP Sharing agreements:
- Create efficiencies in the exchange/trading of IP
- Facilitate research & development of technologies & products
- Create new commercial opportunities by pooling implementation technologies
- Clearing IP blocking positions
- Stimulate access to technology, research tools, etc.
- Reduce transaction costs and burden
- Can help address equity/development /global challenges
- Removing infringement uncertainty

Implications for policy makers

- Bayh-Dole type legislation - a building block in a larger framework for commercialisation of public R&D
- Patents need not be the default option, esp. in life sciences
- Role of collaborative IP mechanisms to foster networks/markets
- Universities and public research are “nodes” in broader networks of innovation
- Ensure incentives and practices compatible with a more open, networked model of innovation
- Funding agencies play a critical role
- Learn from others (experimentation in firms and non-profits foundations)
- Monitor and evaluate!
Alexander von Frankenberg introduced the German High-Tech Gründerfonds, a public-private venture capital funds aimed at the earliest stage of innovative companies, the so-called “seed” stage. The main idea for the inception of the fund was to foster venture capital markets in Germany. Strategic success factors included complete independence from the public sector bodies and, as a result of this, the ability to use private sector incentive schemes. The inclusion of private capital, however small compared to the public holdings, secured access to a highly qualified network of companies and managers in the high-tech research-intensive sector.
### The challenge in 2004: Vastly underutilized potential

<table>
<thead>
<tr>
<th>On one hand ...</th>
<th>... on the other hand</th>
</tr>
</thead>
<tbody>
<tr>
<td>• German economy generates huge trade surplus with high-tech products</td>
<td>• Start-up industry under-developed in Germany: 16 seed investments 2004 and 2005 by members of the German VC association</td>
</tr>
<tr>
<td>• German industries are leading in the world economy (machine tools, automotive, medicine, chemicals, …)</td>
<td>• Venture Capital industry rapidly declining / escaping to later stages</td>
</tr>
<tr>
<td>• Long and successful tradition of small and medium sized companies („Mittelstand“)</td>
<td>• No start-up in DAX 30 since SAP</td>
</tr>
<tr>
<td></td>
<td>• But: Billions of government money spent on technology development</td>
</tr>
</tbody>
</table>

### High-Tech Gründerfonds: Key facts

- **Founded:** 2005
- **Volume:** 272 Mio. EUR
- **Investors:** German Government, KfW, BASF, Dt. Telekom, Siemens, Daimler, Robert Bosch, Carl Zeiss
- **Planned duration:** 6 years investment plus 7 years disinvestment period
- **Focus:** Innovative high-tech companies in the seed phase (start of operations < 12 months)
- **Investment:** 500,000 – 1,000,000 equity per company lead investor
- **Support:** Support through local coaches value add by High-Tech Gründerfonds team
THEME 2: POLICY AND PROGRAMS OF INNOVATION AND COMMERCIALIZATION

Main results

<table>
<thead>
<tr>
<th>Operations</th>
<th>Other results</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Closing of 186 investments(^1) / 226 commitments</td>
<td>• Set-up of a high-number of working partnerships</td>
</tr>
<tr>
<td>• Closing of 138 follow-on investments by third parties(^2)</td>
<td>• Impact on the early stage market on several levels (market share of 50% in the Germany seed market)</td>
</tr>
<tr>
<td>• External capital raised: &gt;209 million Euro</td>
<td>• Number of &quot;produced&quot; paper millionaires: 89</td>
</tr>
<tr>
<td>• Thereof: 71% private capital</td>
<td>• Set-up of high performance organization</td>
</tr>
<tr>
<td>• Eight exits, five profitable</td>
<td>• Fun</td>
</tr>
</tbody>
</table>

\(^1\) 04.01.2000, 02.03.2000, 06.06.2002, 02.02.2003, 04.03.2003, 14.06.2003, 14.06.2004  
\(^2\)  Various public and private investors

Success factors – strategic and conceptual

- Involvement of government representatives, experts with background of public financing and private investors
- Private contribution to the fund (17m, 6.3%)
- Strong understanding of the venture capital business model
- Systematic inclusion of relevant know-how (e.g. mistakes from the past)
- "Independent" management company that can focus on goals ("no political influence")
- Right timing at the bottom of the market
THEME 2: POLICY AND PROGRAMS OF INNOVATION AND COMMERCIALIZATION

Success factors – operational

• Freedom to set up management company with few restrictions (no strings to an existing organization)

• Set-up of a high-performance organization:
  - Consistent breakdown of company goals and variable pay on individual level
  - High recruiting standards
  - Fluctuation consistent with performance

• Significant freedom for investment managers
  - Laptops, mobile phone and mobile e-mail for everyone (2005)
  - no forms to allow job related travel
  - Very flexible work hours, no time sheet recording

• Strong effort to build a positive performance culture
Current Status and Future Prospects of Technology Transfer at the Croatian Ruđer Bošković Institute
Danica Ramljak, Director General, Rudjer Boskovic Institute, Croatia
Danica.Ramljak@irb.hr

Danica Ramljak introduced the Rudjer Boskovic Institute, the preeminent Croatian research institution, and its newly founded transfer company Rudjer Innovations Ltd. Rudjer Innovations Ltd. was founded in 2007. Its main aim is the commercial exploitation of discoveries and inventions from Ruđer’s researchers. Furthermore, the institute supports IPR awareness among its researchers and supports resulting commercialization projects and spin-offs.
THEME 2: POLICY AND PROGRAMS OF INNOVATION AND COMMERCIALIZATION

IRB OVERVIEW BY BRANCHES

- Biomedicine: 15%
- Computing & engineering: 5%
- Chemistry: 30%
- Oceanology: 14%
- Biology: 16%
- Physics: 20%

TOTAL = 867 EMPLOYEES

542 RESEARCH STAFF (344 WITH PhD) + 325 SUPPORT AND TECHNICAL STAFF

198 YOUNG RESEARCHERS
34 YOUNG RESEARCHERS WITH PhD
118 SENIOR RESEARCH ASSOCIATES
95 RESEARCH ASSOCIATES
98 SENIOR RESEARCHERS
MISSION

High quality basic research
Strong involvement in higher education
Leading contribution to the growth of the national economy

VISION

EU Centre of scientific excellence
Delivering knowledge and values to industry, government and academic institutions

SCIENTIFIC PUBLICATIONS

RBI scientists - 6% of the total no. of scientists in Croatia
32% of all Croatian articles cited in Current Content
CC Papers: 2004 - 2009

<table>
<thead>
<tr>
<th>Year</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>364</td>
<td>389</td>
<td>356</td>
<td>408</td>
<td>406</td>
<td>440</td>
</tr>
</tbody>
</table>
How can the best scientific institute in Croatia contribute to development of the TT and National Innovation System?

THERE IS NO EFFICIENT TT and INNOVATION SYSTEM WITHOUT:

• Strong basic research
• Strong applied research
• Strong cooperation between scientific community, academia and industry
• Strong education system
• Strong leadership
• STRONG NATIONAL GOVERNMENT COMMITMENT
THEME 2: POLICY AND PROGRAMS OF INNOVATION AND COMMERCIALIZATION

Intellectual Property and Commercialization

- RBI's Agency founded in 2007
- specialized in commercialization of innovations and technology transfer
- links science and technology with economy and industry.

Portfolio: more than 80 innovations and scientific projects in various fields with commercial potential but primarily in chemistry, medicine, biology, physics and informatics

- 7 employees,
- more than 80 projects (32 outside RBI),
- 32 patent applications
- 7 license agreements, 1 patent granted and 5 spin-offs

Spin off companies

Ruder Innovations
- Commercialization of innovations and technology transfer

Ruder Medikol Cyclotron
- Development and production of radionuclides

Ruder Medikol Diagnostics
- Breast and other genetic hereditary diagnostics

Initium Futuri
- Innovative ICT technologies

BioZyne (in formation)
- Biotech company for R&D in the life sciences (cancer drugs)
THEME 2: POLICY AND PROGRAMS OF INNOVATION AND COMMERCIALIZATION

IF IN NUMBERS

- Investment: $14k EUR
- Ownership: RI 51%, inventors: (4) 49%
- Profit sharing: RI 51%, inventions: (4) 49%

<table>
<thead>
<tr>
<th>Year</th>
<th>2007</th>
<th>2008</th>
<th>Sep 2009</th>
<th>Expected in 2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Projects</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Licences, business contrib.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Revenue (EUR)</td>
<td>0</td>
<td>26631.72</td>
<td>38125.56</td>
<td>cca. 72000</td>
<td>100</td>
<td>150</td>
</tr>
</tbody>
</table>

IF PROJECT PORTFOLIO

- SmartECG - Mobile Heartwork analysis and alarming system
- Vergilius – Navigation for visually impaired
- Eduforia – eLearning and collaboration software
- ePortfelj – Web 2.0 personal investment portfolio manager
- Custom software and consulting services – one big BPR (Business Process Reengineering) project in progress
RMD IN NUMBERS

- Investment: 50k EUR
- Diversification: All 30%, Medical 50%
- Profit Sharing: B, 30%, Medical 20%

<table>
<thead>
<tr>
<th>Year</th>
<th>2008</th>
<th>Sep 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Projects/diagnoses?</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Revenue (k EUR)</td>
<td>0.0</td>
<td>2</td>
</tr>
<tr>
<td>Costs (k EUR)</td>
<td>19</td>
<td>9</td>
</tr>
</tbody>
</table>

Do research and TT at IRB need improvement?

YES!
THEME 2: POLICY AND PROGRAMS OF INNOVATION AND COMMERCIALIZATION

RBI → EU CENTRE OF EXCELLENCE

IMPROVE INTEGRATION
IMPROVE RESEARCH INFRASTRUCTURE
IMPACT PAPERS
INCREASE INTERNATIONAL PROJECTS
COOPERATION WITH INDUSTRY

VISIBILITY
INTERNATIONAL COOPERATION
EDUCATION
PATENTS, FUNDRAISING

Finnish science and technology system

PARLIAMENT
Research and Innovation Council
Government
Advisory Board for Sectoral Research
Ministry of Education
Ministry of Employment and the Economy
Other Ministries
Academy of Finland
Tekes
Sitra
Universities, Polytechnics and Public Research Institutes
Business Enterprises and Private Research Institutes
Plenary V: Skills (Not Just Diplomas) Are Needed in an Innovative Economy: Young Voices Perspective – From Theory to Reality

How are ECA’s education systems responding to the demands of the knowledge economy? Are graduates in ECA prepared to engage in the innovation practices that can ultimately ensure the region’s competitiveness?

In this session, the regional flagship study on skills was presented by the authors, and a “talk-show” discussion involving students from across the region brought a new focus to the analytics of the study. Through the discussion, the panel of students provided a fresh “reality check” based on their own experiences in their school-to-work transition. During a lively discussion, the audience had the opportunity to ask questions to the study authors or any of the members of the youth panel.
Presentation of the Forthcoming World Bank Regional Report on Skills
Lars Sondergaard, Senior Economist, Human Development Department (ECSHD), World Bank
lsondergaard@worldbank.org

Mamta Murthi, Education Sector Manager, ECSHD, World Bank
mmurthi@worldbank.org

Mamta Murthi and Lars Sondergaard presented first results of the forthcoming “World Bank Report on Skills” (published in the late summer of 2010). The authors pointed out that economic welfare depends more and more on innovation, which, in turn, depends on complex and “applicable skills” like the interactive usage of tools and the ability to work autonomously as well as in heterogeneous groups. However, old education systems are made for the needs of the “old economy”, thus not teaching the “right skills”. So what can countries do to improve education?

According to Sondergaard, countries need to “turn the lights on”; implementing quality assurance mechanisms on international models and increasing the accountability for results will make it possible to use financing as an instrument for enhancing the quality of education systems. Thus, the steering process involves a balancing act among three instruments: financing, accountability and autonomy concerning the application of funds. Focusing on excellence before reaching a certain quality level in general, however, would be unhealthy.
THEME 3: HIGHER EDUCATION AND INNOVATION

Innovation requires skills

- Why a session on skills?
  - Future growth will depend more on improving competitiveness and labor productivity
  - This requires innovation
  - Innovation requires skills

Messages and structure of presentation

- What skills are we talking about?
  - Broad set of skills: cognitive, social and life skills

- How well are education and training systems doing?
  - Expanding access
  - Providing skills for all

- What can countries do to improve?
  - Provide better information on quality of education
  - Relying more on incentives to steer sector
Complex skills are needed and all workers need them

There is broad agreement on the skills needed to succeed in work and life

Source: European Survey of Working Conditions 2005

Source: OECD (2005): Definition and Selection of Competencies (DeSeCo) Project
THEME 3: HIGHER EDUCATION AND INNOVATION

Good news: more diplomas are being issued

Gross enrollment rate in tertiary education (%)

Source: World Bank Edstat

But quality indicators suggest ECA countries are falling behind

Source: OECD PISA 2006
Too many students are functionally illiterate

Source: OECD PISA 2006

Students say they are not getting the right skills

Challenges identified by young people (ages 18-30) in the transition from school to work, Turkey 2006

- Lack of jobs: 25%
- Lack of information about jobs: 13%
- Schooling inadequate/not relevant: 43%
- Other: 19%

**THEME 3: HIGHER EDUCATION AND INNOVATION**

**Fraud, corruption and unethical behavior – widespread?**

Students who knew of bribery for a grade or an exam among their faculty (%)

- Bulgaria
- Croatia
- Moldova
- Serbia
- Kyrgyz Republic (*)

(*) Data for Kyrgyz Republic is a based on a slightly different question: students were asked if they had “personal experience with corruption and bribery in their university.”


**Employers agree: they listed “skills” as a main constraint before the crisis**

'Workers' skills had become a constraint on firm expansion by 2008. (percent of firms considering factor a 'major' or 'very severe' constraint) Source: Turmoil at Twenty, World Bank, 2009
When agencies start flexing their muscles, the news hasn’t been good

% of students enrolled in higher education institutions that did not satisfy minimum quality standards (estimate, Georgia 2004)

Let’s face it: we know very little about who succeeds and who fails

- Unhealthy tendency to focus on excellence, rather than the quality achieved by all
- What do we really know about the quality of tertiary education when it comes to creating skills?
  - Which institutions are truly great at imparting skills to their students?
- What happens to students after they graduate?
Example of important unknown

- There are around 35 HE institutions teaching economics in Kiev: 20 private and 15 public
  - Student’s perspective: which institution does a better job at teaching me the skills I need to succeed? (selectivity ≠ high quality teaching)
  - Employer’s perspective: which students outside of the prestigious institutions have skills?
  - Policy maker’s perspective: which institution is performing well? Which institution need sanctions/rewards/support?

The distribution matters!
Slow start in measuring results!

What can policy makers do better?
- Turn the lights on!
  - Measure, analyze, disseminate and use results for policy making
- Different role for central policy makers: less micro-management and more focus on steering
Turning the lights on!

- Tracer studies
- Quality of tertiary
- Quality of vocational education
- Quality of training

Collecting data

Analyzing and disseminating

Using results for decision making

Performance-informed budgeting

Linking incentives to results

Use information on results to steer

- More autonomy in exchange for results
- Use financing as an instrument: tie resources to results
- Increasing accountability for results
Steering involves a balancing act among three instruments

Don’t rely on only one way to strengthen accountability

- Accountability through accreditation and quality assurance… but this takes time!
- Accountability through information and transparency: rankings, performance tables, tracer studies
- Accountability through partnerships with civil society and students
Better use of sector’s resources is needed to pay for better quality

The right policies can have a big impact
The “young voices” Marina Sheryaeva, Mihajlo Babin, Guglielmo Briscese and Victor Valkov gave a very personal view on the education systems they experienced, with special regard to their school-to-work transition. Their complaints “proved” what Murthi and Sondergaard had already stated: In many cases, education systems do not meet the needs of a modern economy, teaching the “wrong” skills or at least failing to impart applicable knowledge. According to the “young voices”, the teaching personal is one of the main problems: With teachers unmotivated to teach (with poor didactical skills), very much specialized and unwilling to join further education, students are not prepared for the needs of the labor market. Additionally, experience of bribable teaching staff has discouraged many students because money seems to be more important than real achievements.
THEME 3: HIGHER EDUCATION AND INNOVATION

Plenary VI: From Lisbon to Europe 2020 – Higher Education and Research as Drivers of Competitiveness

The EU recently launched its revamped competitiveness strategy, Europe 2020. The lead coordinator of the Europe 2020 Strategy team joined the KEF IX to discuss what the transition from the former Lisbon Agenda to the new Europe 2020 Strategy means in the European context, especially with regard to restoring the Union’s economic vitality and improving its global competitiveness. The plenary stimulated a timely discussion on what this may imply on a country policy level, including a discussion of the associated output-oriented country-level targets that had to be agreed on during the June 2010 European Council meeting. The session also facilitated a discussion on key reform areas contributing to the Strategy’s European-level objectives, specifically on employment and skills, as well as on research and development and innovation. The experiences of two new EU member states were highlighted in this context, i.e. Lithuania and Poland.
Gerrit de Graaf gave a brief introduction to the “Europe 2020” Strategy, its central targets and the current circumstances under which the strategy was developed (i.e. the economic crisis and three lessons learned with regard to existing patterns in politics and economics). In conclusion, De Graaf outlined three measures in order to overcome the lacking implementation process of the Lisbon Strategy, i.e. clear targets, development of flagships, and enhanced monitoring and evaluation of the progress.
THEME 3: HIGHER EDUCATION AND INNOVATION

![Diagram of World of R&D 2008]

Size of circle reflects the relative amount of annual R&D spending by the country noted.

**Europe's share of global R&D spending is falling**

![Bar chart showing percentage of R&D spending by region]

Source: Battelle, R&D Magazine (2009)
Nurturing high-tech, high-growth sectors

R&D spending (€ bn) and industrial structure (2008)

The EU is lagging behind major partners as regards the ‘smartness’ of its economy and high competitive pressure arises from developed and emerging economies.

Matching the pace of competition

Investment in R&D in 2008 (billions €)

(Source: 2009 EU Industrial R&D Investment scoreboard)
Taking up the global fight for knowledge

Percentage of students at each proficiency level on the science scale (PISA 2006 – OECD)

Investing in our students and universities

Expenditure on tertiary education (% GDP)

Total spending on tertiary education in the EU (as a % of GDP) is less than half the US level, mainly as a result of lower private spending in Europe.
Taking up the global fight for knowledge

Share in the top institutions of the 2009 Shanghai list

While the EU has 40% of the universities in the top 500 of the Shanghai ranking, the top end is clearly dominated by the US (17 of the top 20 institutions are located in the US).
Mr. Steponavicius presented the recent structural reforms in the higher education and science sectors of Lithuania, which aim at raising both the number of graduates and their qualification in terms of developing competencies corresponding to the needs of the labor market. In this context, among other measures, higher degrees of autonomy were conceded to higher education institutions, and student vouchers for financial support of the best students were introduced.
Starting point 2009

- 12 000 researchers, 6000 with doctoral degrees
- 300 - 400 new doctoral degrees each year
- 200 000 students (60 000 in the colleges)
- 23 university (8 private), 17 state and 18 university research institutes, 23 colleges
- Investments in R&D - 0,8 % of GDP
- 6,7 % researchers in business and industry
THEME 3: HIGHER EDUCATION AND INNOVATION

Financing

ALLOCATIONS FOR SCIENCE AND STUDIES IN 2008-2010
(Millions, €)

HE system in Lithuania

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Universities + Colleges</td>
<td>16</td>
<td>49</td>
<td>49</td>
<td>46</td>
</tr>
<tr>
<td>Total number of students</td>
<td>84 345</td>
<td>204 432</td>
<td>210 400</td>
<td>Approx. 200 000</td>
</tr>
</tbody>
</table>

Distribution of students by the type of HEI's in 2009:

<table>
<thead>
<tr>
<th>Number of HEIs in 2009/2010:</th>
<th>State</th>
<th>Private</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universities</td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td>Colleges</td>
<td>13</td>
<td>10</td>
</tr>
</tbody>
</table>
Reform of Higher education and research system

New Law on Higher Education and Research 30-04-2009:
- Competitive funding of HE (Students’ vouchers)
- Programme based competitive research funding
- Institutional reform of research institutes
- Institutional reform of universities and colleges
- External institutional evaluation
- Intellectual rights protection
- Science Council reformed in to Research Council
- Agency of Research, Innovation and Technologies established

Major goals of the higher education reform

Quality. To create conditions and incentives necessary for the substantial improvement in HE quality

Accessibility. Favorable conditions to all who want and are able to pursue studies

Competitiveness. State funding for the best students and researchers.

Efficient use of resources. Impetus for the rising prosperity of the country
State funding for bachelor studies is given to students, not institutions

State funding for bachelor studies is provided in the form of student vouchers to the best entrants applying to HEI’s:

- Entrants choose freely an educational institution – whether it’s a public or a private one
- State funds allocated for vouchers are divided into 11 areas of studies to meet the demand for different kinds of specialists

11 areas of studies: humanitarian, social, physical, biomedical, technology sciences, artistic and visual arts. Law, business, pedagogy and medicine are separated out of these as separate areas.

First results of the new funding mechanism

- State funding was given to the best university and college students. Since 2009 public funding is also available for part-time studies.
- The number of students in vocational schools have increased responding better labour market needs.
- A number of the weakest study programs didn’t attract enough students and have to be renewed or closed.
- Smaller HEI’s started think about consolidation, first HEIs announced their wish to merge.
- Next to public funding universities were able to attract even more private funding from the self-financed students.
Quality reason – competition among HEI’s
(First year results)

Proportion of student vouchers by type of HE institutions in 2009:
- Universities: state – 98 %, private – 2 %;
- Colleges: state – 91 %, private – 9 %.

25829 students were enrolled in state and private Universities for
1 cycle studies in 2009. Out of this number:
- 45 % studies fully covered by the state (vouchers),
- 55 % pays full price themselves.

15961 students were enrolled in state and private Colleges in 2009.
Out of this number:
- 58 % studies fully covered by the state (vouchers),
- 42 % pays full price themselves.

Increasing accessibility

To ensure real accessibility a state loan system for students has been transformed
and expanded. Since 2009 students can get state–supported loans from the private
commercial institutions (banks) to cover their:
- study costs,
- living expenses,
- part time studies abroad under international agreements.

Objectives:
- The opportunity to provide students with loans has increased 6 times;
- The loans are provided by 4 banks, the competition of which enables students to
  choose the bank offering the lowest interest rate;
- During the studies period the government will compensate interest rate higher than 5
  percent for loans taken to cover their study costs;
- Loans can be taken in national currency (litas) as well as in euro’s
- Repayment of the loans related with the student’s income rates (income contingent).

Social scholarships are also available to students with low socio-economical
background, disable and orphans. This type of scholarship and amount in money is
regulated by the state.
New management and accountability

Governing body

Council
- Highest governing body responsible for strategic decisions. Formed of the members of academic community and outside members appointed by minister according to proposal of National HE Council

Rector
- Highest administrative body responsible for the management of a HEI. Elected by HEI’s Council

Senate
- Highest body dealing with academic matters, approving study programs and securing maintenance of academic standards

Essential enlargement of autonomy

- New legal status – from a budgetary entity into a public entity – more freedom for decision making
- Right to own and manage property entrusted by the state
The main focus in 2010

- Attention to the students enrolled in science and technology studies – more state funded places comparing with other fields of studies
- Attention to the pedagogical studies – less number of state funded places, more state allocations per one study place, additional scholarships
- Renewal of the I cycle study programmes
- Development of joint study programmes to increase the internationalization of HE
- Development of the tools for internal quality assurance systems in HEI’s
- To adapt study infrastructure for the needs of disable students
- Encourage development of practical skills and entrepreneurship of students

10% of Structural Fund support – for HE, research and innovation

EU structural funds – attention to R&D infrastructure, human resources and environment

- R&D Programme for Cooperation Between Public R&D and Business Sectors - Integrated Research, HE and Business Centers (Valleys)
- Common National Integrated Programme – 12 national integrated Programmes in R&D knowledge susceptive economical sectors
- Researchers Career Programme - professional improvement of researchers at all stages of their career

Concentration of Lithuanian R&D potential

- Reorganization of Institutes’ Network
- National Science Programmes
Stimulation of innovation

Investments into:
R&D infrastructure, human resources and environment

Valley’s Programme
National Integrated Programmes

Measures by other ministries for R&D development

Researchers Career Programme

Structural Funds Programmes 2007-2013

- R&D Programme for Cooperation Between Public R&D and Business Sectors (218,06 mil. €)
- Common National Integrated Programme (97,43 mil. €)
- Researchers Career Programme (182,5 mil. €)
- National Higher Education Programme (221,28 mil. €)
Focus on priority fields

- Biotechnology and biomedicine;
- Materials science, physical and chemical technologies;
- Natural resources and agricultural;
- Engineering and IT.
Stimulus for R&D commercialization

Recommendations for Lithuanian science and studies institutions regarding the rights arising from the results of intellectual activities, approved by the order of the Minister of Education and Science December 1, 2009

Recommendations – a consulting guide, setting the guidelines for Lithuanian science and studies institutions on the rights, arising from the results of intellectual activities, and their use, disposal and management.

Consolidation of State Research Institutions’ Network

Before consolidation:
17 State Research Institutes
18 University Research Institutes
10 State Research Institutions

After consolidation:
5 Centers of Science and
6 State Research Institutes
(17 Institutes was integrated into universities)
Actions

- Open international tender for the selection of the Valley Monitoring Group experts announced
- Funding Contracts of the Projects of National Integrated Programs will be signed
- Regulation basis for management of open-access centers
- Legal basis of the Science and Technology Parks renewed

By 2020 Lithuania targets **2% R&D intensity**

**(0,8% in 2009):**

- In the period of the financial crisis, the budget allocations to the higher education and science sector were reduced less than in average to the public sector in total.
- Since 2009, government expenditure on R&D has been increased due to SF allocations.
- New fiscal incentives for R&D: improved financial accounting in business sector is expected;
- Due to reform: new incentives for research and higher education institutions to commercialize R&D results and attract investments from business sector.
- Reformed research and higher education system and renewed infrastructure: foreign investment should increase.
Challenges

• Successful implementation of the HE and research reform
• Successful implementation of EU structural funds programmes
• Strengthening of studies, science and business integration for growth of Lithuania’s economy
• Globalization and internationalization
• Preparedness for New EU financial programming period for 2014-2020
Nina Arnhold and Natasha Kapil gave a short insight into the tertiary education system and the innovative capacities of Poland. In the first part of their presentation, they illustrated the challenges concerning the adaptation of the Polish education system arising from changing demands for skills on the labor market (i.e. tendency for general up-skilling). Moreover, the speakers commented on the weak innovative performance of the Polish economy and outlined possible approaches to improve specific areas (e.g. co-patenting with foreign partners might support the import of technologies into Poland; measures stimulating business R&D such as tax breaks or matching grants).

The questions and answers concentrated on reform experiences from Lithuania (e.g. statutory vs. competitive funding of R&D institutions and student vouchers) and researchers’ and students’ mobility between the EU member states and neighboring countries such as Turkey (e.g. visa problems, blue card system).
Poland has gone through the crisis in flying colors

Real GDP growth rates in percent

Source: DataStream, World Bank, Global Economic Prospects 2010: Crisis, finance, and growth

EC sees potential growth still significant but lower

Source: European Commission
Capital was driver in the past – and is likely to be in future
In meantime revisit employment and labor productivity

Poland: Contributions to Potential Growth /1

Source: Epstein and Macciarelli (2010)

Policy levers to support growth

- **K** Capital contribution -- investment
- **L** Labor contribution -- more employment
- **TFP** Through better human capital, skills
- **TFP** Through innovation and absorption

Focus of the study
Employment can still drive growth

- EU 2020 headline target: 75% of the population aged 20-64 should be employed
- Poland: 65% employed → substantial gap
- Why is the employment rate so low in Poland?
  - 50+
  - Women
  - Youth
- Focus on education and skills as one key factor affecting employment outcomes

Changing skills demand side – does the education system keep up?
From low level to high level skills

The difference between the shares in job creation and in job destruction by occupation 2009
**THEME 3: HIGHER EDUCATION AND INNOVATION**

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**LM entrants lack skills required by employers**

*Graph showing the percentage of employers reporting certain skills as “most lacking” in 2006.*

---

**Labor market continues to reward TE**

*Graph showing the average relative earnings growth at the tertiary level of education between 1997 and 2007 and average relative earnings at the tertiary level of education deviation from the OECD average (2007).*

*Source: Education at a Glance, 2009*
THEME 3: HIGHER EDUCATION AND INNOVATION

‘The learning rich get richer’
Adult participation in E&T only 50% EU average

Comment: Urban, 23% with 62% population urban. Rural: 12% with 18% LM participations (but only 10% farmers)

Demand for higher level/more generic skills
But education system needs paradigmatic shift

<table>
<thead>
<tr>
<th>FROM:</th>
<th>TOWARDS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>Knowledge, skills and competences</td>
</tr>
<tr>
<td>Input-based ‘standards’</td>
<td>‘Learning outcomes’ – assessment of area &amp; learner keeps, also focus on end of a process of learning</td>
</tr>
<tr>
<td>Isolated degrees</td>
<td>Qualification frameworks – developed with employers &amp; specialists</td>
</tr>
<tr>
<td>Focus on formal education</td>
<td>Combination of formal, informal, non-formal</td>
</tr>
<tr>
<td>Focus on subject-related skills</td>
<td>Combination of generic and subject-related skills</td>
</tr>
<tr>
<td>Tracking and ‘dead ends’</td>
<td>Flexible learning paths, permeable systems</td>
</tr>
<tr>
<td>Power of traditional providers</td>
<td>More open systems/markets</td>
</tr>
<tr>
<td>Education is a defined phase in life</td>
<td>Lifelong Learning</td>
</tr>
</tbody>
</table>
Emerging policy recommendations on education/skills

- Develop overarching lifelong learning approach: consider lifecycle of the learner, starting from Early Childhood Development
- Connect to employers: National Qualifications Framework, governance of TE, schools
- Increase access to adult education: good practice in Scandinavian countries, Ireland, etc.
- Take demographic developments into account when steering TE sector
- Revamp Bachelor
- Connect TE and research as well as third function of universities
- Equitable TE financing system
- Quality Assurance: internal QA and additional transparency tools

Improving Poland’s Capacity to Innovate

THE WHAT:

EUROPE 2020 TARGET 3% R&D/GDP
- Poland barely spends 0.6% R&D/GDP
- Desirable? Yes, But ...efficiency first
- Timing Right? Perhaps, build on reform momentum

MINUTE SHARE OF PUBLIC R&D $ REACHES FIRMS & IS UNDERUTILIZED
- Firms not in the driver’s seat (except SFs)

DISINCENTIVES FOR APPLIED RESEARCH IN PUBLIC RDIs
- RDIs gauged on metrics: publications, professorships
- Not by revenue for R&D/engineering services to firms
Poland spends little on R&D...
...with very poor outcomes.


Where does public money go?

Source: Ministry of Science and Higher Education.

Current expenditures by type of R&D activities and type of units (in thousands of PLN, 2007)

Source: Nauka i Technika w 2007, Central Statistical Office.
Theme 3: Higher Education and Innovation

R&D personnel employed by entity

The devil is in the detail...

Expenditures on R&D activity by sources of funds (2007): JBR s

Source: Nauka i Technika w 2007, GUS
What do you get in return?

Invention and co-invention in Poland and the EU-7 (USPTO Data)
THEME 3: HIGHER EDUCATION AND INNOVATION

Leveling the innovation playground
THE HOW:
Restructuring the Research Sector
• Poland has initiated RDI reform, but not PAS.
• Looming Challenges
  — Financing: Categorization based on Differentiated Output
  — Institutional: Exit Path for Commercialized RDIs Unclear
Leveraging Public Financing to Stimulate Enterprise R&D
• Matching Grants go for Technology Absorption (less for Innovation)
  — Introduce International Peer Review
  — Build Domestic Capacity for Technical and Commercial Reviews
• Improving Utilization of R&D Tax Breaks
  — Delay vs. Double: Applied too early in start up lifecycle
  — Firms wary of tax inspections
• KEF IX lessons: Innovation Assistant Program
Promoting International Knowledge Flows via Co-patenting
• Revamping MOSHE “Patent Plus” Program to promote co-inventions

Messages EU 2020
• Countries need to be ambitious (e.g. employment)
• Connect smart and inclusive growth (e.g. equity in education)
• Guidance and peer learning on common issues (e.g. Math Science Technology)
• R&D target: Feasible? Desirable?
• How to support countries, how to keep countries on track?
**Plenary VII: Overview of the German Research System**

Universities, industry research and non-university public research represent the three main pillars of the German research system. Particular attention is paid to the development and commercialization of innovation. The German government transfers innovations through specific channels. Acatech, the German Academy of Science and Engineering, is one example of supporting knowledge transfer between science and industry. The non-university research pillar is composed of four big research institutes; among these, the Max-Planck-Gesellschaft conducts fundamental research, while the Fraunhofer-Gesellschaft focuses on applied research. Linking research and industry at an early stage is of great importance to innovation success.
Universities and Research Organizations in Germany - An Overview
Reinhard F. J. Hüttl, President, German Academy of Science and Engineering

Prof. Dr. Dr. Reinhard Hüttl gave a brief overview on the German landscape of universities and research institutions, describing the function of central actors and providing information on the financial structures of the system. In this context, he illustrated that, despite ranging above OECD average and despite constant increases in R&D intensity, German R&D expenditures still exhibit a considerable gap compared to internationally leading countries like Sweden, Japan or the U.S.
“Innovation is essential for the sustainable development of the economy”

> Prosperity requires employment,
> Employment requires innovation,
> Innovation requires science and many bright minds!

University and extra-university research organisations according to research focus
**Higher education in Germany – reforms**

- **Bachelor and master degrees**
  - **Accreditation**
  - **Tuition**
  - **Selection tests**
  - **Autonomy of universities**
  - **Private universities**

**Excellence Initiative**
(Graduate Schools, Clusters of Excellence and Institutional Strategies to Promote Top-level Research in Germany)

**Aim:**
To strengthen the international competitiveness of education and research

**Partnerships e.g. between universities and the private sector**

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**Extra-university research organisations**

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Expenditure</th>
<th>Ratio of funding</th>
<th>External funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helmholtz Association of National Research Centres (HGF)</td>
<td>2.1 billion €</td>
<td>90 : 10</td>
<td>900 million €</td>
</tr>
<tr>
<td>Max Planck Society for the Advancement of Science (MPG)</td>
<td>1.3 billion €</td>
<td>50 : 50</td>
<td>260 million €</td>
</tr>
<tr>
<td>Fraunhofer Society (FhG)</td>
<td>395 million €</td>
<td>90 : 10</td>
<td>800 million €</td>
</tr>
<tr>
<td>Leibniz Association (WGL)</td>
<td>852 million €</td>
<td>50 : 50</td>
<td>350 million €</td>
</tr>
</tbody>
</table>

All data for 2009
THEME 3: HIGHER EDUCATION AND INNOVATION

Gross domestic expenditure for research and development (GERD) in Germany in billion € and as a share of the gross domestic product

R&D expenditure in 1991-2008
Share of GDP in % (Target: 3 %)
Science and reunification

> Decisions in the years 1989/1990:
  • Establishment of an integrated science landscape

> Changes implemented from 1990 to 1992:
  • The discontinuation of the science system of the GDR and the development of a new science system in eastern Germany utilizing the West German system as a role model

Science and reunification

> The results (not including Berlin):
  • Establishment or re-establishment of numerous universities and research institutes (56 universities of applied science, private etc./5 universities were discontinued; 3 new universities were founded (Cottbus, Frankfurt/Oder, Erfurt)
  • Performance level remains differentiated (2.3% of excellence initiation funding)
  • R&D investments: western Germany 67% industry sector 33% public sector eastern Germany 80% public sector
  • Personal: 50% reduction at universities
  • Discontinuation of academy research system new approach: working academies
The INSTITUTION
The voice of science and technology in Germany

- acatech: independent and self-determined representation of science and technology in Germany and abroad
- Institutional funding by the federal government and the 16 federal states as a national academy since January 2008
- Under the patronage of the Federal President of Germany since October 2008
- The network (status: spring 2010):
  - 329 members in Germany and abroad
  - 83 senators
  - Head office in Munich
  - Capital office in Berlin

The OBJECTIVES
Providing knowledge, guidance and support

Scientific recommendations
- acatech advises policy makers and the public on future technology issues based on the best available scientific knowledge

Knowledge transfer
- acatech offers a platform for exchange that fosters cooperation between science and business

Promotion of young scientists and engineers
- acatech is committed to supporting young scientists and engineers

Voice of science and engineering
- acatech represents the interests of science and engineering at a national and international level
International activities

Bilateral cooperations

Membership

> The European Council of Applied Sciences, Technologies and Engineering (Euro-CASE)
> acatech Member of the Board Rainer Kopp as vice-chairman
> The International Council of Academies of Engineering and Technological Sciences (CAETS)

Financing
Ensuring independence and stability

Donations and project sponsorship

Core work
> Projects
> Events
> Other activities

Institutional sponsorship (by federal government and federal states)

Operational basis
> Academy
> Head office and capital office
The supporters of acatech
Status: 2010

At a glance
The topical networks

- Education and Knowledge Management
- Mobility
- Biotechnology
- Nanotechnology
- Energy, Construction, Infrastructure and Environment
- Product Creation
- Medical and Sanitary Engineering
- Safety and Security
- Foundation of Engineering and Technology
- Materials Science and Engineering
- Information and Communication Technology
Challenge:

How Germany can become a leading provider of electromobility

Opportunities for electromobility
Five arguments specifically relevant for Germany

1. **Urban mobility** – improving air quality (incl. noise) in urban areas

2. **Multimodal mobility** – close “networking” with the well-developed public transport system

3. **Independent mobility** – reduced dependency on fossil fuels

4. **“Regenerative” mobility** – in combination with sustainable power generation, particularly regenerative energies

5. **“Buffering” mobility** – with controlled charging times, possibly as an energy buffer in the long-term (bidirectional vehicle-to-grid)
An overview of acatech recommendations:

1. Electromobility should be viewed as an interdisciplinary national effort – no company, sector or scientific discipline can master this on its own
2. Germany must become a leading supplier of electromobility – not just the lead market
3. Promotion instruments should be concentrated
4. Pilot regions should be strengthened as a window for export
5. Electromobility must be embedded in the overall context – the future “mobility” should not be reduced to electromobility
6. Promotion of “systemic” education at all levels

Effect: National e-mobility Summit, May 3 - coordinated by acatech

New challenge for acatech!

Define, organise and conduct National Innovation Dialog for the German Government on the request of the Chancellor Frau Dr. Merkel
“Ageing in Germany”

AKADEMIENGRUPPE ALTERN IN DEUTSCHLAND

A joint academy group of acatech and Leopoldina

> Aim: identifying the potential of an ageing society
> Interdisciplinary approach including representatives from industry and society
> Topics: ageing – and: family, civil society, politics, urban and regional development, environment, technology, elderly people as a work force
The result: a recommendations volume entitled “More Years, More Life” – and eight materials volumes

Handing over of the “More Years, More Life” volume to the President of the Federal Republic of Germany, Horst Köhler

“Ageing in Germany”

Opportunities for individuals:
- Recognising and taking advantage of the opportunities offered by a new image of ageing – 7 years difference
- “Take care of your health” - prevention
- Lifelong learning – brain/mind fitness
- New job options – experience counts

Consequences for companies and the working world:
- To employ older people and to employ them longer
- To optimise the organisation of work for ageing people
- To flexibly accommodate changes in job profiles
- To continuously invest in improving the qualification of employees – until retirement
"Ageing in Germany"

AKADEMIENGRUPPE ALTERN IN DEUTSCHLAND

> The sustainable society:
  - Revising the negative image of ageing
  - Rethinking the concept of the rigid three-stage life plan
  - Creating new opportunities for societal participation
  - Renewing the generation contract
Fraunhofer Within the German Research System
Hans-Jörg Bullinger, President, Fraunhofer Gesellschaft

Prof. Dr. Hans-Jörg Bullinger raised one essential question that all countries with an explicit research orientation have to face: How can financial resources be effectively transferred into knowledge and, vice versa, how can knowledge be transferred into new and marketable products and processes? With regard to this question, Prof. Dr. Hans-Jörg Bullinger emphasized the role of applied research institutions and the relevance of an effective collaboration between research and industry partners.
The Fraunhofer-Gesellschaft

Fraunhofer undertakes applied research of direct utility to private and public enterprise and of wide benefit to society.

Our Customers:
- Industry
- Service sector
- Public administration

Joseph von Fraunhofer

Discovery of "Fraunhofer Lines" in the sun spectrum

New methods of lens processing

Head of Royal Glass Factory

Researcher

Inventor

Entrepreneur

Research and development for the industry, service sector and public administration

e.g.: 2 patent applications each working day

1.6 billion € budget per year
Fraunhofer Project Center for Production Management and Informatics in Budapest

Cooperation Partners:
1) SZATKI *Computer and Automation Research Institute* at the Hungarian Academy of Sciences MTA
2) FhG-IPA
3) FhA PL

Opening May 2010 in Budapest
Director of the Project Center:
László Monostori,
D.Sc., Deputy Director Research, MTA SZATKI,

Demands on a Fraunhofer Institute

- Scientific competence proved by the recognition of the scientific community
- Well-balanced financial mix of different independent sources
- Market success and entrepreneurial competence proved by contracts with industry and government
- Professional networking with other Fraunhofer Institutes and externals
### The Profile of the Fraunhofer-Gesellschaft

- **59 Institutes**
- **17,000 employees**

#### 7 Groups:
- Information and Communication Technology
- Life Sciences
- Microelectronics
- Light & Surfaces
- Production
- Materials and Components - MATERIALS
- Defense and Security

#### Fraunhofer Groups

**Microelectronics (founded 1996)**
- CNT, Dresden
- ENAS, Chemnitz
- ESK, München
- HHI, Berlin
- IAF, Freiburg
- IS, Erlangen
- IMS, Duisburg
- IPMS, Dresden
- ISIT, Rezehoe
- IZM, Berlin
- FHR, Wachtberg
- Fokus, Berlin
- IDMT, Ilmenau
- IZFP, Saarbrücken

**Light & Surfaces (founded 1998)**
- FEP, Dresden
- IDF, Jena
- IPM, Freiburg
- IWS, Dresden

**Life Sciences (founded 2000)**
- IBMT, St. Ingbert
- IGB, Stuttgart
- IME, Schmallenberg, Aachen
- ITA, Karlsruhe
- IVV, Freising
- IZL, Leipzig
- EMB, Lübeck

**Materials and Components - MATERIALS (founded 1997)**
- EMI, Freiburg
- IAP, Peißenberg
- IBP, Stuttgart
- ICT, Pfinztal
- IMK, Bremen
- IKT, Dresden
- ISC, Würzburg
- ISE, Freiburg
- IIS, Karlsruhe
- IIT, Saarbrücken
- LBF, Darmstadt
- WWI, Braunschweig
- ITWM, Kaiserslautern

**ICT Group (founded 2001)**
- FIRST, Berlin
- FIT, St. Augustin
- FOKUS, Berlin
- FOKUS, Karlsruhe
- IAO, Stuttgart
- ISM, Ilmenau
- RIK, Wachtberg
- RSPE, Kaiserslautern
- RSE, Darmstadt
- RDG, Karlsruhe
- RST, Berlin

**Production (founded 1998)**
- IFI, Magdeburg
- IMK, Dortmund
- JPL, Stuttgart
- IPK, Berlin
- IF, Aachen
- FOKUS, Karlsruhe

**Defense and Security (founded in 2002), Research for Ministerial Departments**
- IFI, Magdeburg
- IPK, Berlin
- FOKUS, Karlsruhe
- IAE, Freiburg
- FHR, Wachtberg
- ISE, Kaiserslautern
- IAO, Stuttgart
- ISM, Ilmenau
- IZL, Leipzig
- EMB, Lübeck
- IIT, Saarbrücken
- IWS, Dresden
Fraunhofer Alliances

- Adaptronics
- Advancer
- Ambient Assisted Living
- Building Innovation
- Digital Cinema
- eGovernment
- Energy
- Food Chain Management
- Grid Computing
- Nanotechnology
- Optic Surfaces
- Photokatalysis
- Polymer Surfaces
- Rapid Prototyping
- Cleaning Technology
- Simulation
- Water Systems (SysWasser)
- Traffic and Transportation
- Vision

Innovation Clusters -
Close Cooperation between Governments of German Länder, Universities, Industry and Fraunhofer

- Digital Production
- Mechatronic Machine Systems
- Optical Technologies (JOIN)
- Automotive Quality Saar
- Digital Commercial Vehicle Technology (DNT)
- Nano for Production
- Personal Health
- Adaptronics
- Future Security BW
- Technologies for Hybrid Lightweight Construction (KITe HyLITE)
- Multifunctional Materials and Technologies (MultiMaT)
- Polymer Technologies
- Virtual Development, Engineering and Training (VIDET)
- Turbine Production Technologies (TurPro)
- Secure Identity
- Maintenance, Repair and Overhaul in Energy and Traffic (MRO)
- Electronics for Sustainable Energy Use (under development)
- Cloud Computing for Logistics (under development)
Frontline themes - Tomorrow’s opportunities

People need
■ an affordable healthcare system
■ security
■ energy
■ communications
■ mobility
■ and a clean environment.

The Fraunhofer-Gesellschaft has identified strategic research areas in which it is seeking answers to these challenges of the future. In focusing on twelve frontline themes, the Fraunhofer-Gesellschaft is pointing out particularly effective courses of action. Its objective is to employ new technologies to devise solutions that will make our life healthier, safer and simpler, and will be kinder to the environment.
THEME 3: HIGHER EDUCATION AND INNOVATION

Frontline themes - Tomorrow’s opportunities

- Energy storage in power grids
- Solar and wind-generated electricity on demand
- Visual analytics
- A clear overview in the data jungle
- Green powertrain technologies
- New impetus for eco-friendly cars
- Hybrid material structures
- Combining the best of the best
- Energy self-sufficient sensors and sensor networks
- Vigilant clusters
- Integrated localization technology
- On the move – quick and safe

The German Hightech Strategy

- Pooling strengths
  - Cooperation between science and industry
  - Strategic partnerships and innovation alliances
  - Accelerate and streamline the transition from product development to a marketable product
- Focusing on lead markets
  - Health, climate and resource efficiency, mobility and security
- Improving framework conditions
  - Improving conditions for SME
  - Protection of IP improved
  - Innovation-oriented procurement
- Evaluating strategies
Federal Ministry for Education and Research is about to launch update of German Hightech Strategy

- In 2006 the German government published its Hightech Strategy focusing on 17 topical and 10 horizontal fields
  - first time ever Germany announced a comprehensive research strategy
- The roll-out of the strategy was guided by a research council (»Forschungsunion«) chaired by Arendt Oetker and Hans-Jörg Bullinger
- The »Forschungsunion« reviewed the status in 2009 and published recommendations for an updated Hightech Strategy to be implemented in the new election period (2009-2013)
- The re-appointed Federal Minister for Education and Research, Annette Schavan, re-constituted the research council under the leadership of Arendt Oetker and Hans-Jörg Bullinger in February 2010 and is about to publish an update of the Hightech Strategy

Suggestion of “Forschungs-Union” for architecture of updated german Hightech Strategy:
Focus on global challenges

Global Challenges ➔ Five Strategic Fields

- Health
- Climate/Energy
- Security
- Mobility
- Communication

Key Technologies:

Innovation Drivers (Horizontal/Regulatory Issues)

Business   Science
How Basic Research Generates Innovation
Peter Gruss, President, Max Planck Gesellschaft

Prof. Dr. Peter Gruss expanded on this issue by picking up the concept of the knowledge cycle which aims at the integration of knowledge creation, knowledge utilization and the transfer of knowledge. He emphasized the long-term role of basic research within the innovation process.
Knowledge-based society

Innovation = creative destruction = driving force of the economy

Incremental innovations
Development of existing products and processes

Breakthrough innovations
Development of new added-value potential

R&D – a key engine of growth

"A Contribution to the Theory of Economic Growth" (1956)
Technological advancement, rather than labour and capital, is the driving force in economic growth in industrial countries:

The introduction of new technologies accounts for up to 80% of gross domestic product

→ Investment in R&D is the key factor for economic growth in modern industrial countries.
Basic research – a factor in modern growth policy

<table>
<thead>
<tr>
<th>Country</th>
<th>Basic research expenditure as a percentage of GDP 1995</th>
<th>2004</th>
<th>Basic research as a percentage of R&amp;D 1995</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>0.44</td>
<td>0.50</td>
<td>17.5</td>
</tr>
<tr>
<td>Austria</td>
<td>0.31</td>
<td>0.39</td>
<td>21.5</td>
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<tr>
<td>France</td>
<td>0.52</td>
<td>0.52</td>
<td>21.9</td>
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<tr>
<td>Germany</td>
<td>0.45</td>
<td>0.45</td>
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<tr>
<td>Norway</td>
<td>0.25</td>
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<tr>
<td>Portugal</td>
<td>0.14</td>
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<td>Switzerland</td>
<td>0.07</td>
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<tr>
<td>Japan</td>
<td>0.39</td>
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</tr>
<tr>
<td>China</td>
<td>0.01</td>
<td>0.07</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Hans Gernsbach, Center of Economic Research, Swiss Federal Institute of Technology:

„How much a country should invest into basic research can only be answered within a new growth concept. (...) We find that the more technologically advanced a country is, the more the amount of optimal basic research expenditures increases.“

Source: Hans Gernsbach, Basic Research and Growth Policy, December 2007 (Table OECD MISTI, Vol. 2006/2)

Importance of publically funded research for industry

Academic research of vital importance for innovative products.

Source: F. Hage et al. 1997. The increasing importance of US technology
Economic benefits of research institutions for Boston/USA

- 8 universities
- Expenditure on research: US$ 1.7 billion p.a.
- Economic significance for the regional economy: estimated at US$ 7 billion
- Around US$ 3.9 billion is generated for the greater Boston area from salaries, goods, services and construction.
- 50,000 direct + 35,750 indirect jobs

Source: Engines of Economic Growth, 2003

The Max Planck Society

Mission

Advancing innovative and interdisciplinary research of highest quality at the frontiers of knowledge

Knowledge must precede application.

(Albert Einstein, 1879 - 1955, Nobel Laureate 1921)
The Max Planck Society ...

- ... promotes outstanding researchers from all nations who enjoy autonomy in the selection of their research subjects and methods
- ... combines unusual research subjects
- ... generates flexible, dynamic research units: Max Planck Institutes
- ... imposes stringent quality control
- ... receives stable long-term institutional funding
- ... is internationally oriented
- ... supports actively technology transfer: Max Planck Innovation

Facts and Figures

- >13,300 staff members (Jan 1st, 2009)
- plus 7,000 junior and guest scientists (Jan 1st, 2009)
- annual budget 1.3 billion € (2009)
  plus 300 million € third-party funds
Max Planck Institutes

80 Institutes and Research Units headed by
271 Scientific Directors

ESSAY

The end of the science superpowers

Could the end of US world dominance over research mark the passing of national science giants, ask J. Rogers Hollingsworth, Karl H. Müller and Ellen Jane Hollingsworth.

"Excellence in science requires nimble, autonomous organizations — qualities more likely to be found in small research settings"

"In the recent past, some of the most creative small centres were the Rockefeller University, ..., and various Max Planck Institutes"
International benchmarks

1. Nobel Prize Winners since 1948
   - 2007 Gerhard Erler (Chemistry)
   - 2005 Theodor Hänsch (Physics)
   - 1995 Christiane Nüsslein-Volhard (Medicine)

2. Impact of MPS publications

   1. Harvard University
   2. Max-Planck-Gesellschaft
   3. Stanford University
   4. University of California, Berkeley
   5. Massachusetts Institute of Technology
   6. University of Washington
   7. John Hopkins University
   8. University of California, Los Angeles
   9. University of Michigan
   10. University of California, San Diego

   Number of high impact publications (Top 1%), January 1997 - December 2007
   Source: ISI - Essential Science Indicators

Impact through scientific breakthroughs

- Decoding of Neanderthal genome (S. Pääbo)
  - Sequencing of prehistoric DNA laid the foundation for molecular investigation of human evolution

- STED microscopy (S. Hell)
  - Ultrahigh-resolution fluorescence microscopy (nanoscopy) enables observation of dynamic sub-cellular processes

- Optogenetics (E. Bamberg)
  - Light-induced stimulation of specific nerve cells with millisecond precision enables investigation of individual circuits of the brain in living organisms
Direct economic impact

- Basic research is the foundation for overall technological advancement in the wider sense
- Examples of basic research which has led to economic impact at the Max Planck Society
  - Manufacture of polyethylene and polypropylene
  - RNA interference
  - Sutent
  - Flash software for magnetic resonance imaging
  - STED microscopy
  - Optical frequency comb

Max Planck Innovation GmbH – impact in Germany

Start-ups since 1990:
- 89 companies have been founded including:
  - 58 license-based spin-offs
  - 26 scientist spin-offs
  - 5 experience spin-offs
- 53 are actively supported by MI
- 45 are VC financed
  (37 private + 8 corporate)
- 7 companies listed on the stock market, 13 merger & acquisitions
- 26 portfolio companies, including
  - 6 exits and 3 partial exits
  - 5 write-offs
- \( \approx 2,330 \) jobs
- IPTEC price 2008
THEME 3: HIGHER EDUCATION AND INNOVATION

The „Innovation Gap“

- Industry as well as venture capital is mainly interested in advanced technology
- In biotechnology, for example, this means
  - preferably in clinical phase I or II
  - compounds (validated “leads”)
  - broad platform technologies (such as RNA interference)
- Value of early technology is decreasing or the technology cannot be licensed at all, e.g. targets
  - Biotech industry as “incubator” for early technology is currently missing (concentrating on advanced projects as well)

Possible Solutions for Bridging the “Innovation Gap”

Validation of academic results

- Support programs (i.e. BMBF, BMWI, Max Planck internal)
- Fraunhofer Society
- Incubators
- Drug discovery centers
The VC crisis in Europe

- As a result of the “big crunch” in 2007 and 2008, the already limited amount of VC was further reduced.
- Even later stage companies are struggling to attract new investors to cope with their financial needs.
- VC-dependent industries are facing a potential collapse.

We need things such as

- Attractive tax systems for
  - Venture capital
  - R&D intensive companies
- Improvement of exit strategies
  - by Mergers and Acquisitions
  - by IPOs

International Co-operation
Partner Groups of Max Planck Institutes in ECA countries

Partner Groups

- are headed by selected talented former MPI PostDocs with proven research records
- offer a „return incentive“ for highly-skilled researchers
- form the basis for sustainable research links and
- contribute to a competitive research environment in their home countries
Research Partners in ECA countries 2008 (in total 672)

International cooperation of the Max Planck Institutes
- creates scientific „added value“ and „critical masses“ and
- increases scientific production and productivity.

> Best-practise: „bottom-up“ initiatives

Strategic instruments of institutional international collaboration

* International Max Planck Centers
  - Example India (Delhi):
    Indo Max Planck for Center Computer Science, IIT Delhi
    - Top-quality basic research in Computer Science (CS)
    - Bridge between the Indian and German CS communities
    - Center of excellence for faculty and students’ career development
    - Various instruments applied: Partner Groups, Ph.D. students exchange, „Visiting Professorships“

* International Max Planck CAS Partner Institute for Computational Biology (Shanghai)
  - Combining efforts and expertise of top-class research institutes
  - Joint training of junior researchers
  - Close institutionalized links between CAS and MPG
How basic research generates innovation

Summary

* Curiosity driven research delivers the basis for breakthrough innovations
  = essential for knowledge based modern societies

* Attention has to be paid to better bridge the innovation gap
  = need for further technology transfer activities and funding

* International cooperation is essential to further strengthen the science and innovation system
  = expand internationalisation with big and small countries

Support Programmes

* KMU Innovativ / BioChance (BMBF)
  * For projects in the field of life sciences

* Additional funding programmes “under construction” (BMBF)

* Exist Forschungstransfer (BMWI)
  * For all fields of technology

* Max Planck internal programmes
  * For all fields of technology
Collaboration with Fraunhofer-Gesellschaft

- **Background**
  - Joint Initiative for Research and Innovation of Germany’s federal and state governments

- **Focus**
  - Collaboration in areas of shared expertise and across disciplines
  - Application-related projects, new technologies

- **Realisation**
  - 19 projects since 2005
  - Expenses up to 2010: € 8.2 million
  - Duration: three years
  - Funding from the President’s Strategic Innovation Fund

---

Live Science Incubator – caesar (“LSI”)

The LSI is a pre-seed incubator to foster spin-offs from academic research organizations by providing

- Financing (up to € 1 million per group per year, for three years, follow up financing possible)
- 1st class infrastructure
- Professional support
  - Writing the business plan
  - Project management
  - General administration
  - Getting experienced managers
- Support in follow-on financing rounds
Lead Discovery Center ("LDC")

* The Team of the LDC is developing the pharmaceutical candidate molecules up to the proof of concept in animal models ("leads")

* The LDC integrates biology, medicinal chemistry and pharmacology with a professional management, resulting in a fully integrated platform

* The LDC applies the latest criteria from pharmaceutical industries ("big phama") and works in close collaboration with the Max Planck Institutes

LDC – Part of a Concept

* The LDC is part of a concept for a Drug Discovery and Development Center ("DDC")

* The DDC comprises two independent companies:
  * The Lead Discovery Center (LDC) and
  * The Development Company (DevCo)

* DevCo will – as a free competitor with other companies – license the pharmaceutical candidates generated by the LDC.

* DevCo's purpose:
  * To carry out further steps in the development of new and innovative drug candidates
  * Initiate early clinical studies on patients
Mr. Burgbacher emphasized that public support for innovation and entrepreneurship should focus on creating appropriate framework conditions. He focused on education, public research institutions, regulations and a reliable IPR system. According to Burgbacher, state support should be used only in cases of market failure. The measures of economic policy should be designed in a way that keeps them from hampering the allocative mechanisms of the market.

**Honorary Speaker: Ernst Burgbacher, State Secretary, Federal Ministry of Economics and Technology (BMWi)**

Internationally competitive companies are the key element of a dynamic and sustainably growing economy. But what are the main characteristics of these companies? How do they succeed on the global market? And how do they evolve from innovative start-ups to successful companies? This plenary, addressed these questions, discussing what kind of political environment and support schemes are most favorable to promoting innovative companies.

In Germany, the so-called “Mittelstand” represents a unique success story of companies. Mr. Kirchhoff, CEO of a very successful “Mittelstand” company and member/chairman of many international advisory groups dealing with SMEs issues, shared his experience. He explained key elements and characteristics that have enabled his company to succeed on the global market. Thereafter, Mr. Lindner, chairman of the German Committee on Eastern European Economic Relations, focused on the importance of linking education, research and corporate practices in order to turn innovative ideas into successful products.
Arndt Kirchhoff stated that processes of both value creation and innovation are performed within networks. He concluded that clusters (consisting of companies, universities and political decision makers) play an important role in the economic development of a companies and regions/countries. Kirchhoff stated that it could be helpful for Central and Eastern Europe (CEE) countries to attract relatively big companies, since they are key to necessary suppliers that might follow the big companies.
THEME 4: BREAKING THE WALL TO SUCCESS

SMEs in Germany

The Importance of SMEs

- SMEs represent 99.7% of all companies in Germany
- SMEs generate 40.8% of all taxed turnovers
- SMEs hire 70.2% of the employed workforce
- SMEs conduct 81.9% of all vocational trainings

Graphic: BMWA / Source: IBM Bonn

EU industry:
German share continually on high level

Gross Value Added share of the EU industry of selected countries

Share in %, 2008

- Germany 27.5
- Great Britain 13.3
- Italy 12.0
- Spain 6.4
- France 11.9
- Rest of EU 29.8

Share in %, 1995 – 2008

Germany: 27.5
Great Britain: 15.5 – 13.5
Italy: 12.0 – 11.6
Spain: 6.4 – 5.0
France: 7.0 – 5.5

Source: Eurostat

© BDI
THEME 4: BREAKING THE WALL TO SUCCESS

The industry stands for nearly 90% of the German export

Export of goods and services from Germany in mio. €

Share of foreign automobile manufacturing
Domestic and overseas manufacturing

Source: Statistisches Bundesamt

Source: VDA Statistics
THEME 4: BREAKING THE WALL TO SUCCESS

Global Orientation - German automobile manufacturing in overseas tripled in the last 15 years

The industry stands for over 90% for the R&D expenditures of the German economy

Research and Development expenditures of the German economy, in mio. €

Source: Stifterverband für die deutsche Wissenschaft
THEME 4: BREAKING THE WALL TO SUCCESS

Automobile R&D expenditures

Automobile R&D expenditures vs. – total in mio. € of automobile and components manufacturers

Automobile: € 20,934 mio.

R&D expenditures total: € 57,404 mio.

Source: Stiftungsfonds für die deutsche Wissenschaft, January 2019

When function and effect are in harmony. Handtools from WITTE.
THEME 4: BREAKING THE WALL TO SUCCESS

Fair balance is the ultimate benchmark.
Waste disposal vehicles and logistic concepts of FAUN.

Fascination of individual mobility.
Tailormade cars for handicapped people.
KIRCHHOFF Automotive.

Structure and Stability through intrinsic values. Technology, that gets under the skin.

Global

- Production Plant
- Sales Office
- Tec Center
- Joint Venture
THEME 4: BREAKING THE WALL TO SUCCESS
THEME 4: BREAKING THE WALL TO SUCCESS

Polarization of the automobile markets

The polarization of automobile markets follows income-structures:
Downturn of the middle segments in favour of Premium and Low-Cost

Polarization of the automobile markets

<table>
<thead>
<tr>
<th>Year</th>
<th>Classical Market-structure</th>
<th>New Market-structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td>Premium-Segment: 20%</td>
<td>Premium-Segment: 19%</td>
</tr>
<tr>
<td></td>
<td>Volume-Segment: 22%</td>
<td>Volume-Segment: 22%</td>
</tr>
<tr>
<td></td>
<td>Low-Cost-Segment: 58%</td>
<td>Low-Cost-Segment: 58%</td>
</tr>
<tr>
<td>1995</td>
<td>Premium-Segment: 17%</td>
<td>Premium-Segment: 17%</td>
</tr>
<tr>
<td></td>
<td>Volume-Segment: 67%</td>
<td>Volume-Segment: 67%</td>
</tr>
<tr>
<td></td>
<td>Low-Cost-Segment: 16%</td>
<td>Low-Cost-Segment: 16%</td>
</tr>
<tr>
<td>2006</td>
<td>Premium-Segment: 18%</td>
<td>Premium-Segment: 18%</td>
</tr>
<tr>
<td></td>
<td>Volume-Segment: 19%</td>
<td>Volume-Segment: 19%</td>
</tr>
<tr>
<td></td>
<td>Low-Cost-Segment: 63%</td>
<td>Low-Cost-Segment: 63%</td>
</tr>
<tr>
<td>2015</td>
<td>Premium-Segment: 26%</td>
<td>Premium-Segment: 26%</td>
</tr>
<tr>
<td></td>
<td>Volume-Segment: 13%</td>
<td>Volume-Segment: 13%</td>
</tr>
<tr>
<td></td>
<td>Low-Cost-Segment: 61%</td>
<td>Low-Cost-Segment: 61%</td>
</tr>
</tbody>
</table>

Definition: low-cost: Vehicles with costs less than $10,000

The financial crisis will accelerate the development of new competencies in the area of alternative drive systems
€67 billion added value with new modules

Added Value according to Modules and Working Concepts
In bn. €, 2025, worldwide

<table>
<thead>
<tr>
<th>Module</th>
<th>Added Value (bn. €)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chassis (791, 10%)</td>
<td></td>
</tr>
<tr>
<td>Gear Mechanism (214, 10%)</td>
<td></td>
</tr>
<tr>
<td>Motor (162, 14%)</td>
<td></td>
</tr>
<tr>
<td>Car Body Structure (583, 5%)</td>
<td></td>
</tr>
<tr>
<td>Exterior (208, 19%)</td>
<td></td>
</tr>
<tr>
<td>Interior (154, 13%)</td>
<td></td>
</tr>
<tr>
<td>E/E (697, 34%)</td>
<td></td>
</tr>
</tbody>
</table>

New Modules

<table>
<thead>
<tr>
<th>Module</th>
<th>Added Value (bn. €)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Modules</td>
<td>€67 bn. €</td>
</tr>
</tbody>
</table>

Number of Pieces (millions)

- Combustion Engine: 75.3
- Mild Hybrid: 6.5
- Full Hybrid: 2.3
- Electric Plug-in: 1.2

Source: Oliver Wyman.
THEME 4: BREAKING THE WALL TO SUCCESS

The electric vehicles demand will significantly increase after 2030

Drive technology assumptions

<table>
<thead>
<tr>
<th>Internal combustion engine (ICE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Despite market share loss to remain dominant technology</td>
</tr>
<tr>
<td>• Continued downsizing trend (2.5 cylinders, range extender)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hybrid technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Mild Full hybrid to dominate midterm due to limits of battery tech.</td>
</tr>
<tr>
<td>• Plug-in (with range extender) to lead &gt;2025 due to lower CO2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electric vehicle technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Optimized battery cost and performance as of 2030</td>
</tr>
<tr>
<td>• Increased fossil fuel costs</td>
</tr>
<tr>
<td>• Purpose designs with clear USP for customer</td>
</tr>
</tbody>
</table>

Market development in mio. units, automobile, worldwide

Source: Oliver Wyman

Who makes the car
THEME 4: BREAKING THE WALL TO SUCCESS

<table>
<thead>
<tr>
<th>Major Component System Summaries</th>
<th>US $/Vehicle</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audio &amp; Telematics</td>
<td>325</td>
<td>2.34</td>
</tr>
<tr>
<td>Steering</td>
<td>385</td>
<td>2.77</td>
</tr>
<tr>
<td>Passenger Restraints</td>
<td>355</td>
<td>2.55</td>
</tr>
<tr>
<td>Body Glass</td>
<td>150</td>
<td>1.08</td>
</tr>
<tr>
<td>Body &amp; Structural</td>
<td>2,445</td>
<td>17.59</td>
</tr>
<tr>
<td>Interior</td>
<td>1,330</td>
<td>9.57</td>
</tr>
<tr>
<td>Fuel System</td>
<td>355</td>
<td>2.55</td>
</tr>
<tr>
<td>Wheels &amp; Tires</td>
<td>355</td>
<td>2.55</td>
</tr>
<tr>
<td>Exhaust</td>
<td>300</td>
<td>2.16</td>
</tr>
<tr>
<td>Suspension</td>
<td>495</td>
<td>3.56</td>
</tr>
<tr>
<td>Braking</td>
<td>445</td>
<td>3.20</td>
</tr>
<tr>
<td>Axles, Driveshafts &amp; Components</td>
<td>835</td>
<td>6.01</td>
</tr>
<tr>
<td>Transmission</td>
<td>1,255</td>
<td>9.03</td>
</tr>
<tr>
<td>Climate Control &amp; Engine Cooling</td>
<td>710</td>
<td>5.11</td>
</tr>
<tr>
<td>Engine</td>
<td>2,410</td>
<td>17.34</td>
</tr>
<tr>
<td>Electrics &amp; Electrical</td>
<td>1,750</td>
<td>12.59</td>
</tr>
<tr>
<td></td>
<td><strong>13,900</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

New structures of added value are required

The increasing complexity of development has to be addressed with new structures of added value outside the OEM
THEME 4: BREAKING THE WALL TO SUCCESS

Clustermanagement NRW
www.autocluster.nrw.de

Electric Mobility RWTH

Networks and working groups
- Network eMobile module
- Working group „plastic augmentative E-automobile”
- Network battery production

Division Electric Mobility
- Bundling of the RWTH/FH Aachen institutes competencies and activities in the thematic area of E-Mobility

StreetScooter AG
- Development of an electric automobile from maturity phase to series production
- Association of SMEs participation at the StreetScooter AG
- Participation from 10/04/year onwards possible

SMEs consortium
- Electric mobility laboratory

Temporary availability of controlling and production technologies:
- Electric motor, power electronic, battery, automation & assembly
THEME 4: BREAKING THE WALL TO SUCCESS

Networking with other institutes and companies

VIA – Association of innovative automotive suppliers.

VIA Consult
Head office: Ople/Biggesee
Founded: 2001
Employees: 8

• Business and division organization
• Process organization and optimization
• Improve business performance
• Initiation of new technologies
• Restructuring (Change Management)
• Initiation of new management systems

Partner of VIA Consult:

• Cooperation management
• Benchmarking
• Mentoring of cross company working groups
• Creation of purchasing pools

VIA Oberflächentechnik
Head office: Lennestadt-Grevenbrück
Founded: 1999
Employees: 72

VIA Laser- und Systemtechnik
Head office: Suhl
Founded: 1999
Employees: 35

VIA Lasertec
Head office: Lennestadt-Würdinghausen
Founded: 1999
Employees: 24
Opportunities and Recommendations

Increase activities in foreign countries

25% export, but only 3% invest (all companies)

Cooperation and networking (Cluster)

Utilisation of Resources at Non-Core-Business
Bundle activities in education and innovation
(see example VIA: www.v-i-a.de)
Rainer Lindner stated that the Central and Eastern European countries constitute important export destinations for German companies (in 2009, CEE accounted for 16% of German foreign trade). Focusing on Russia, Lindner referred to the Russian government’s modernization strategy. One outcome of this strategy is the INNOGRAD project. INNOGRAD is a technology park that is going to be established near Moscow. According to Lindner, the top-down approach of the project could hamper the development of this technology park. However, since the management of INNOGRAD is performed by businessmen instead of civil servants, this problem might be overcome.
THEME 4: BREAKING THE WALL TO SUCCESS

The Committee on Eastern European Economic Relations (OA):
- Founded in 1952 at the height of the Cold War
- German business' oldest "regional initiative"
- More than 150 member companies and associations
- Chairman of the Board: Prof. Dr. Klaus Mangold
- Seat of secretariat in Berlin with 20 members of staff

Responsible for the regions:
Russia, Belarus, Ukraine, Southeastern Europe, Central Asia and Caucasus

Der Ost-Ausschuss...
- Flanks and promotes German companies' activities
- Focuses and represents the country-specific interests of German business in Germany and in the 22 target countries
- Represents German business in bilateral bodies
- Organises delegation visits, conferences, background talks and events with government representatives and entrepreneurs
- Provides a network of contacts and up-to-date information on economic developments in the target countries
- Supports the development of the Eastern European market economies through advisory and stipend programmes
- Promotes scientific and civil society dialogue
THEME 4: BREAKING THE WALL TO SUCCESS

Importance of German trade with the CEE region

- In 2009 Germany traded goods with CEE totalling EUR 234 billion (OA countries: EUR 95 billion)
- In 2009 the total CEE region generated 16 percent of foreign trade (USA: 6.5 percent)

Chart: Development of trade with the 22 OA countries since 1996

EUR billion. Sources: Committee on Eastern European Economic Relations, Federal Statistical Office

CEE: Great need to catch up as regards hi-tech

Germany obtains its raw materials and products with low real net output ratio mainly from CEE. Eastern Europe is not a well-developed location for hi-tech research and development

Shares of internationally registered patents in the field of international hi-tech industry (OECD 2008):

USA: 36.5%
Japan: 15.9%
Germany: 9%
Rest of the world: 38.6%

Russia’s share is a little more than 0% and only in the sub-areas nanotechnology (0.5%) and nuclear technology (3%)
THEME 4: BREAKING THE WALL TO SUCCESS

**Linking education, research and corporate practice**

**Excellent basic research in Central and Eastern Europe / Good basic training for skilled workers**

- Research should be more industrial-applications oriented (Model: Fraunhofer)
- Cluster formation: start-up centres at universities / incubators / Venture Capital (Silicon Valley / Innograd near Moscow)
- Promote innovative SMEs / tax breaks for research in private-sector companies
- Innovation begins with apprenticeship training: company-related training models / technical colleges

**Innovation begins with apprenticeship training:**

**Dual training and further training schemes**

- On-the-job training and attending vocational schools in parallel ensures companies in Germany can develop personnel according to their needs (dual training scheme)
- Innovative and basic training structure / final examination
- State promotion of further education measures
- State promotion of business start-ups
Know-how Transfer through German investors

- Foreign investors enhance the innovation capacity of domestic economies: As there are no dual vocational training schemes in Eastern Europe, German companies are developing their own training and further training schemes in the relevant countries.

  Training and further training of more than 70,000 construction workers and architects in nine training centres in Russia.

  Training in cooperation with local commercial schools since 2000. After great success in Poland, Russia and Romania, extended to include the Czech Republic and Slovakia in 2008.

  „Science to Business“ programme in Russia / Ukraine.

Know-how Transfer through German Investors

- MBA programme in cooperation with the FHTE Esslingen and the Moscow Power Engineering Institute.

- Suppliers for training and further training organisations. Establishment of learning systems for automation technology and mechatronics at Eastern European universities and technical colleges.

- Since 2004 graduates from the Technical University and staff of dealer service-centres have qualified as skilled workers in the areas of service, diagnosis and repairs at the Daimler Automotive Academy Perm.
Innovation for agriculture – Working Group on Agriculture in the OA

German Agricultural Centre in the Ukraine (DAZ)
(Tscherkasi area)

- Further training measures for specialists and management from the agriculture sector
- In the first year 2009 a total of 2000 participants attended the integrated training courses for the agricultural technology industry, the crop industry and pest control manufacturers
- Successful linking of industry, policy-makers, teaching and research
- Possible to increase crop yields by approx. 60 percent

Project work of the Committee on Eastern European Economic Relations

Belarus / Moldova / Ukraine:
Promotion of private-sector structures

Belarus / Kasakhstan / Usbekistan:
Advanced management training

Russia:
German-Russian talks Baden-Baden / Advanced engineering training

West Balkans:
German business' Zoran Djindjic Internship Programme for the West Balkans
Summary:
Objective is to extend the value creation chain on the domestic market

**Present**
- Dependency on raw materials exports and semi-finished products (oil, gas, crude steel, wood, grain)
- Inflexible industrial complexes inherited from the communist period / little competition
- Research has little practical relevance
- Difficult investment conditions for foreigners / protectionism
- SME small share of GDP (Russia: 17 percent)

**Future**
- „Intelligent business“ with long value creation chains on the home market
- SME structures benefit competition and innovation / diversification of business along regional strengths
- Interlinking of research, education and business
- Promotion of know-how transfer through foreign investors
- SME large share of GDP (Germany: 60%)

**THEME 4: BREAKING THE WALL TO SUCCESS**
Plenary IX: Climate Change and Innovation

Meeting climate change and development goals requires a significant stepping-up of international efforts to diffuse existing technologies and develop new ones. Public and private investment – now in the tens of billions of dollars per year – needs to be steeply ramped up to several hundreds of billions of dollars annually. This panel examined pressing innovation and technology diffusion needs in ECA for climate change mitigation and adaptation. The rapidly growing role of climate change innovation in global competitiveness and possible entry points for ECA countries in this market were discussed.
Mr. Racine’s presentation concentrated on climate-smart innovation. He stated that this kind of innovation could help to mitigate and adapt to the impacts of climate change. Racine gave three reasons why ECA countries should focus on climate-smart innovation: First, adaption relies on local innovation. Second, win-win opportunities can be seized. Third, ECA countries should avoid being the last in the game. Regarding the stimulation of climate-smart innovation in ECA, Racine suggested two main measures: the implementation of regulations and mandatory performance standards as well as price signals. However, according to Racine, regulations and price signals alone cannot solve the market and system failures associated with innovation. It is also necessary to improve the business environment, to facilitate climate-smart FDI and create conditions for local production of climate-smart technologies, and to introduce climate-smart innovation policies.
THEME 4: BREAKING THE WALL TO SUCCESS

WHAT IS CLIMATE-SMART INNOVATION?

<table>
<thead>
<tr>
<th>Sector</th>
<th>Mitigation</th>
<th>Adaptation</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport</td>
<td>✓</td>
<td></td>
<td>Electric vehicles</td>
</tr>
<tr>
<td>Industry</td>
<td>✓</td>
<td></td>
<td>Energy efficiency</td>
</tr>
<tr>
<td>Energy supply</td>
<td>✓</td>
<td></td>
<td>Renewable energy</td>
</tr>
<tr>
<td>Waste management</td>
<td>✓</td>
<td></td>
<td>Recovering/reducing methane from waste</td>
</tr>
<tr>
<td>Building</td>
<td>✓</td>
<td>✓</td>
<td>Storm-resistant buildings, energy efficiency</td>
</tr>
<tr>
<td>Agriculture</td>
<td>✓</td>
<td>✓</td>
<td>Drought resistant crops</td>
</tr>
<tr>
<td>Forestry</td>
<td>✓</td>
<td>✓</td>
<td>Processing and use of forest products</td>
</tr>
<tr>
<td>Human health</td>
<td>✓</td>
<td></td>
<td>Health monitoring and surveillance systems</td>
</tr>
<tr>
<td>Coastal adaptation</td>
<td></td>
<td>✓</td>
<td>Geographical planning systems for coastal zones</td>
</tr>
<tr>
<td>Water</td>
<td>✓</td>
<td></td>
<td>Non-water based sanitation</td>
</tr>
</tbody>
</table>

WHY BOTHER WITH CLIMATE-SMART INNOVATION IN ECA?

-> REASON 1: ADAPTATION RELIES ON LOCAL INNOVATION

- Water availability is expected to decrease everywhere but Russia
- ECA's poor transport, power and housing infrastructure is expected to be under significant stress

Yield gap is already 4.5 times larger than yield increase from climate change

WHY BOTHER WITH CLIMATE-SMART INNOVATION IN ECA?
-> REASON 2: THERE ARE WIN-WIN OPPORTUNITIES

- Energy technology can promote business competitiveness

<table>
<thead>
<tr>
<th>Percentage of Firms that Consider Electricity a Problem in Doing Business (%)</th>
<th>2005</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIS South</td>
<td>21%</td>
<td>31%</td>
</tr>
<tr>
<td>CIS North</td>
<td>9%</td>
<td>8%</td>
</tr>
<tr>
<td>Southeastern Europe</td>
<td>26%</td>
<td>46%</td>
</tr>
<tr>
<td>EU10 (Central Europe)</td>
<td>11%</td>
<td>41%</td>
</tr>
<tr>
<td>Europe and Central Asia Region</td>
<td>17%</td>
<td>47%</td>
</tr>
</tbody>
</table>


WHY BOTHER WITH CLIMATE-SMART INNOVATION IN ECA?
-> REASON 2: THERE ARE WIN-WIN OPPORTUNITIES

- Many climate change technologies are already financially viable

THEME 4: BREAKING THE WALL TO SUCCESS

WHY BOTHER WITH CLIMATE-SMART INNOVATION IN ECA?
-> REASON 3: DON’T BE THE LAST ONE IN THE GAME

- Clean technology investments are experiencing phenomenal growth


WHY BOTHER WITH CLIMATE-SMART INNOVATION IN ECA?
-> REASON 3: DON’T BE THE LAST ONE IN THE GAME

- But where is ECA?

THEME 4: BREAKING THE WALL TO SUCCESS

WHY BOTHER WITH CLIMATE-SMART INNOVATION IN ECA?

-> REASON 3: DON’T BE THE LAST ONE IN THE GAME

- ECA has the world’s highest carbon intensity

How can you stimulate Climate-Smart Innovation in ECA?

- Command and control:
  - Regulations and mandatory performance standards
  - ...but careful, this is a double-edged sword
THEME 4: BREAKING THE WALL TO SUCCESS

HOW CAN YOU STIMULATE CLIMATE-SMART INNOVATION IN ECA?

- Price signals
  - Remove subsidies to high-carbon technologies
  - Remove tariffs on climate-smart technologies
  - Tax carbon
  - Introduce feed-in tariffs for renewable energy

HOW CAN YOU STIMULATE CLIMATE-SMART INNOVATION IN ECA?

- Regulation and price signals in action in China

Number of electric bicycles produced in China:

1998 = 40,000
2008 = 21,000,000
($11 billion industry)

HOW CAN YOU STIMULATE CLIMATE-SMART INNOVATION IN ECA?

- But regulations and price signals alone can’t solve the market and system failures associated with innovation
- Improve the business environment
- Facilitate climate-smart FDI and create conditions for local production of climate-smart technologies
- Introduce climate-smart innovation policy
  - Public R&D on climate-smart innovation
  - Research-industry linkages
  - Climate-smart industry standards
  - Climate-smart technology extension programs in industry and agriculture
  - In countries with a critical mass of innovation such as Russia, Poland and Turkey, introduce climate-smart innovation support promotion instruments in the private sector: matching grants, innovation prizes, etc.
Dr. Florian Weig stated that the share of sectors for which energy plays a key role was particularly high in Eastern European countries. According to Weig, clean-tech solutions (e.g. mobility, buildings, industrial high-tech, IT and IT services, energy) could develop a global market potential of €2 trillion by 2020. The main drivers for growth in clean-tech industries are increasing energy costs, a concentration in the delivery of oil and gas as well as regulations for climate protection. A radical customer orientation and new business models are essential preconditions to realize the market potential. Weig identified three advantages for clean-tech in the ECA region: First of all, the high energy dependency of ECA industries makes them the perfect breeding and testing ground for many clean-tech applications. Secondly, the strong R&D and engineering culture provides a strong innovation base. Thirdly, established partnerships in many clean-tech industries allow quick access to know-how.
THEME 4: BREAKING THE WALL TO SUCCESS

The share of sectors for which energy plays a key role is particularly high in Eastern European countries.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Germany</th>
<th>Japan</th>
<th>Eastern Europe</th>
<th>Italy</th>
<th>France</th>
<th>Great Britain</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobility</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buildings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy-intensive industries</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Industrial High Tech</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT and IT services</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revenues of relevant sectors</td>
<td>2,380</td>
<td>3,210</td>
<td>1,720</td>
<td>1,420</td>
<td>1,460</td>
<td>1,360</td>
<td>6,320</td>
</tr>
<tr>
<td>EUR billions p.a.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total market revenues</td>
<td>5,380</td>
<td>7,460</td>
<td>4,119</td>
<td>3,640</td>
<td>4,170</td>
<td>4,370</td>
<td>21,070</td>
</tr>
<tr>
<td>EUR billions p.a.</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>


McKinsey’s assessment of energy efficiency levers in the global abatement cost curve:

- **Solar**
- **Avoided deforestation America**
- **CCS, coal retrofit**
- **Air conditioning**
- **Lighting systems**
- **Insulation improvements**

**Clean technologies are products or solutions that**
- Lead to a step change of 50%+ in energy efficiency vs. existing technology
- Are disruptive to their industry
- Develop global growth clusters

SOURCE: McKinsey, Valentin
THEME 4: BREAKING THE WALL TO SUCCESS

Cleantech centers of growth are developing a global market potential of EUR 2 trillion in 2020

<table>
<thead>
<tr>
<th>Sector</th>
<th>2008</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobility</td>
<td>15</td>
<td>325</td>
</tr>
<tr>
<td>Buildings</td>
<td>87</td>
<td>180</td>
</tr>
<tr>
<td>Industrial High Tech</td>
<td>84</td>
<td>105</td>
</tr>
<tr>
<td>IT and IT services</td>
<td>8</td>
<td>105</td>
</tr>
<tr>
<td>Energy industry</td>
<td>45</td>
<td>345</td>
</tr>
</tbody>
</table>

CAGR Percent
- Mobility: 29%
- Buildings: 7%
- Industrial High Tech: 8%
- IT and IT services: 18%
- Energy industry: 13%

1 Include energy-efficient IT, IT for energy management, smart grid, IT based traffic systems

SOURCE: McKinsey report, "Wettbewerbsfaktor Energie"

Radical customer orientation and new business models key to realizing market potential

Main levers
- Adapt application to meet customer needs precisely
- Design-to-value, e.g., cogeneration solution to reuse rejected paper
- Design-to-cost, e.g., using less costly components in CHP systems for residential customers
- Financing models, e.g., rate payment models for energy-efficient consumer products
- Business model transformation, e.g., energy contracting solutions for buildings
- Raise customer awareness of TCO benefits
- Value-selling, e.g., clearly defining and communicating value to the customer and offer alternative operating/financing models

Mindset of radical customer focus to bring energy-efficient products to scale

1 Combined heat and power
2 Total cost of ownership
**How is your glass? Half empty?**

Following the wave is already promising
- Economic competitiveness: Many Cleantech applications have short payback periods – good models to cross the initial investment barriers are needed
- Jobs: In typical Cleantech industries like renewable energies about 50% of value add is in designing and installing the system locally
- Energy independence: Energy efficiency reduces dependence from unreliable or costly supply
- Environmental benefit: Lower pollution levels and higher quality of life

But...
- Accept technology leadership by others: US, Germany, China all have quite a headstart

**How is your glass? Half full?**

Surfing the wave leads to real opportunity
- Still emerging opportunities: Most Cleantech markets have no established industry structure and are expanding constantly; no single technology or business model winning so far
- ECA advantage 1: High energy dependency of ECA industries makes them the perfect breeding and testing ground for many Cleantech applications
- ECA advantage 2: Strong R&D and engineering culture providing a strong innovation base
- ECA advantage 3: Established partners in many of the Cleantech industries to quickly access know-how

⇒ What is your strategic posture? Where is your Cleantech master plan?
THEME 4: BREAKING THE WALL TO SUCCESS

Energy plays a key role in 40% of the global economy
2008 worldwide revenues, EUR billions

- Mobility: 7,650
- Buildings: 7,440
- Energy-intensive industries: 9,830
- Industrial High Tech IT and IT services: 1,710
- Energy industry: 8,780

100% = 36,500
100% = 90,750

60% 40%


The energy crisis and climate change are forcing politicians and industry to act on energy efficiency

Energy efficiency discussion driven by 3 underlying issues

- High energy prices in long term
  - Energy prices volatile, but increasing in long term, e.g., by 2.5 - 3.5% p.a. for German industry
  - Driver: sharply increasing demand for primary fuels, especially in developing regions

- Concentration of supply
  - Indigenous local resources being depleted, e.g., EU gas supply will shrink by 15 - 20% by 2020
  - Remaining resources increasingly under political control of exporting countries

- Climate policy objectives
  - Challenging national targets for energy efficiency, e.g., in Germany and the US
  - EU CO₂ trading schemes will likely be extended to more industries; long-term CO₂ prices climbing
THEME 4: BREAKING THE WALL TO SUCCESS

Our definition of clean technologies – Cleantech – and respective centers of growth

Definition
We focus on clean technologies/products/solutions that:
- ... can improve energy efficiency (or decrease GHG emissions) by at least 50% beyond historic trajectory
- ... are thus disruptive
- ... develop into centers of growth with average growth rates of 13% p.a.

Example – automobile drive technology

<table>
<thead>
<tr>
<th></th>
<th>Automoblies with</th>
<th>Increase in energy efficiency above historical average</th>
<th>Automoblies sold</th>
<th>CAGR Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard com-</td>
<td>55</td>
<td>&lt; 50%</td>
<td>22</td>
<td>-7</td>
</tr>
<tr>
<td>bustion engines</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optimized com-</td>
<td>2</td>
<td>&gt; 50%</td>
<td>42</td>
<td>29</td>
</tr>
<tr>
<td>bustion engines</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hybrid or elec-</td>
<td>1</td>
<td></td>
<td>13</td>
<td>24</td>
</tr>
<tr>
<td>tronic motors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Centers of growth

SOURCE: McKinsey report, "Wettbewerbsvorsprung Erneuerbare Energie"

Already in 2008, over EUR 100 billion investments flowed into the Cleantech sector across all asset classes worldwide

Global Cleantech investment flows

<table>
<thead>
<tr>
<th>EUR billion</th>
<th>2004</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>43% p.a.</td>
<td>24.2</td>
<td>100.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source</th>
<th>1. Excluding M&amp;A and MBO deals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2. USD converted to EUR with exchange rate of 0.71 EUR/USD</td>
</tr>
</tbody>
</table>

SOURCE: World Economic Forum report, "Green Investing 2009"
C. Innovative financing models – Berlin Energy Agency aligns investment and benefits for building retrofitting

- Berlin Energy Agency manages retrofits of large buildings
- Example projects include schools, offices, hospitals, and residential buildings
- Public-private partnership of city of Berlin, Vattenfall and KfW (Federal Promotional Bank)
- Program already transferred to several ECA cities

Energy systems company, e.g., equipment supplier

Key benefits
- No up-front investments
- Professional retrofit plan leveraging full savings potential
- Positive cash flow from energy savings from day 1
- New business generated through endorsement of Berlin Energy Agency
- Additional revenues if retrofit measure more effective than planned

SOURCE: Berlin Energy Agency

D. Energy contracting models can bridge high up-front costs

Energy contracting example, Siemens Building Technologies

Both customer and contractor benefit from energy savings, creating a win-win situation

Contractor
- Makes investment for energy-saving measures
- Receives payment within guaranteed amortization period
- Does not need to pay for up-front investment
- Does not assume any risk
- Benefits from any upsides of energy savings

Customer
- Reduced costs due to performance-based solutions
- Guarantees savings

Contracting model transformed business from selling mere equipment to selling energy efficiency service

SOURCE: Siemens Building Technologies
Mr. Pavlovic focused his presentation on the experience of the Western Balkans and Uzbekistan. In this context, he stated that the major framework conditions (e.g., energy policy and strategy, energy carrier prices, privatization, service market, EE product market) are better developed in the Western Balkans countries than in Uzbekistan.
Major framework conditions

### Framework for less countries

- **Energy Policy & Strategy**
  - Yes
  - Yes/No, but mostly not in place
- **Feed In Tariffs**
  - Yes
  - Mostly
- **Energy carrier prices**
  - Almost/Cost reflective
- **Primary energy resources**
  - In preparation
- **Financial IEE schemes**
  - Not completed
- **Privatization**
  - Not enough developed, TA needed
- **Service market**
  - Developed
- **IEE product market**
  - Developed

### Framework for more countries

- **Energy Policy & Strategy**
  - No
  - Not in place
- **Feed In Tariffs**
  - No
- **Energy carrier prices**
  - No cost reflective (Gas only 50 US$/1000 m3)
- **Primary energy resources**
  - Gas, huge reserves
- **Financial IEE schemes**
  - In preparation
- **Privatization**
  - Not completed
- **Service market**
  - Not enough developed, TA needed
- **IEE product market**
  - Developing

---

**Energy Efficiency in Public Buildings (SER, MNE; WB)**

**Evaluation & Reporting**

**Technical monitoring**

**Social monitoring**

**DEA**

**‘BEFORE’**

**‘AFTER’**

Social monitoring

Technical monitoring
THEME 4: BREAKING THE WALL TO SUCCESS

Traditional Credit Lines (EBRD, KfW, IFC, etc.)

- IFIs do not want to destroy local financial market
- Typically hire project and verification consultant
- Credit conditions are similar at the local commercial market with some benefits (longer maturity or grace period, for instance)

WeBSEDFF (EBRD) – http://websedff.com

- Incentive payments will be paid upon technical completion of the investments to eligible Borrowers
- CO2-based Incentive Payments
- IP = CO2 emissions avoided per year x Price per ton of CO2 x Annuity factor (depending on discount rate and number of years over which CO2 emissions reductions will be remunerated)
**Challenges**

- Outdated and life spent of both production and energy technologies
  - Large technical potential for EE improvement
  - Energy carrier prices not cost reflective – smaller market potential
  - Difficult to make distinction between IEE vs. refurbishment, replacement, production extension - misunderstandings
- Faster EE product penetration than development of new services
- Commercial banks still treat these markets as high risks area -> expensive loans – TA for development of new product ‘IEE loan’
- Privatization ongoing – focus on renewal of physical production, not on energy and IEE; faster development of service market – TA needed!
- Oversized capacities – real challenge how to structure the approach
- Demand Side Management in factories – demand is high!
- Training of consultants (EA, BP, BAT, etc.) – demand is high
Growth Opportunities in the Cleantech Industry
Nikolai Dobrott, Managing Partner, Apricum - The Cleantech Advisory

Nikolai Dobrott stated that the global primary energy demand was projected to grow by 34% between 2010 and 2030. Globally, the deployment of renewable energy has significantly grown over the past years. According to Dobrott, the promotion of clean technologies represents a highly attractive opportunity to meet future energy challenges. In this context, the advantages of clean technology include lower dependency on fossil fuels, energy security through a diversified energy mix, decentralized energy supply and cost-effective opportunities for rural electrification, highly reduced CO₂ emissions, and the creation of a local growth industry with qualified jobs.

With regard to Germany, Nikolai Dobrott found that renewable energies had become a significant industry with more than 290,000 jobs (in 2009). He also referred to the Eastern German “Solar Valley” as an example for successful cluster development. According to Dobrott, the development of self-sustaining clean-tech clusters should follow a three-way approach focusing on domestic demand, local manufacturing as well as R&D.
THEME 4: BREAKING THE WALL TO SUCCESS

Between 2010 and 2030 global primary energy demand is projected to grow by 34%.

Projected Primary Energy Demand [Mtoe]

Globally renewable energy deployment has grown significantly.

World renewable net electricity generating capacity development [GW]

Source: IEA Renewables information 2009.
Promoting clean technologies represents a highly attractive opportunity to meet future energy challenges.

Advantages of clean technologies

- Less dependency on fossil fuels and prices
- Energy security through diversified energy mix
- Decentralized energy supply and cost-effective opportunities for rural electrification
- Highly reduced CO₂ emissions and opportunity for CDM projects
- Creating a local growth industry
- Qualified jobs

Source: Clean Edge 2009

Global renewable energy market size in 2008 and 2018e [billion USD]

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biofuels</td>
<td>34.6</td>
<td>105.4</td>
</tr>
<tr>
<td>Wind</td>
<td></td>
<td>51.4</td>
</tr>
<tr>
<td>Solar PV</td>
<td>139.1</td>
<td>80.6</td>
</tr>
<tr>
<td>Total</td>
<td>325.1</td>
<td>115.9</td>
</tr>
</tbody>
</table>

Within ten years installed renewable capacities in Germany have almost quadrupled.

Cumulative installed capacities [GW]

Source: BMU 2010
THEME 4: BREAKING THE WALL TO SUCCESS

Renewable energies have become a significant industry in Germany.

- 16.1% of electricity consumption
- 8.4% of heat production
- EUR 17.7 bn investment in new installations (+19.4%)
- EUR 33.4 bn in revenues (+8.9%)
- 292,900 jobs in total

Source: BMU 2010

The eastern German ‘Solar Valley’ – an example for successful cluster development.

- Area: 108,585 km²
- Inhabitants: ~16 million (1/5 of Germany’s total; incl. 3.5 million in Berlin)
- Eastern Germany features the world’s largest PV industry cluster:
  - Wafer-based technology: 28 companies with production capacity of more than 3.7 GW
  - Thin-film technology: 26 companies
  - Equipment suppliers: 13 large companies
  - Research: several world-class institutes
  - Education: several universities and colleges with solar-specific courses
  - Approx. 15,000 direct employees

Source: Germany Trade & Invest 2009.
By implementing effective policy measures, Germany has taken the lead in solar energy within a few years.

Annually installed PV capacities [MWp]  

PV industry turnover development [m EUR]

Renewed feed-in tariff law  
Renewed feed-in tariff law  
Feed-in tariff law  
100,000 roofs program

Source: BMU 2010.

Best practice example for short term policy measures:  
100,000 roof program in Germany.

Key data of the program

Effects:
• Generated 345 MW of installed capacity, almost 100% of total PV growth during this period
• 73,787 loans supported
• Total loan volume: EUR 1.6 bn.
Costs: ca. EUR 250 million
Policy design:
• Long maturity loans with low interest rates: 1.9% p.a. undertaken by state-owned KfW bank
Further policy measures during program:
• Renewable Energy Sources Act (2001)

Source: Apriem Research 2010
THEME 4: BREAKING THE WALL TO SUCCESS

Reliable government support leads to high installed capacities and the development of local manufacturing.

Major drivers for cluster development are dependent on political will and commitment.
Apricum proposes a three-way approach to develop a self-sustaining Cleantech cluster.

**Domestic demand**
- Extension of market incentive schemes (e.g. FIT), specifically targeting identified key solar applications.

**Local manufacturing**
- Developing targeted manufacturing incentives in identified key solar applications.

**R&D**
- Enabling targeted incentives for key innovations
- Promoting Cleantech and solar energy R&D
- Exploiting the full potential of the pool of well-educated and versatile workforce.

Self-sustaining Cleantech cluster

Apricum has the experience and strength to support your location in cluster development.

- Global Cleantech industry and market expertise competency
- Experience in economic development:
  - Thorough understanding of industry requirements for market entry, location analysis and site selection
  - Excellent connection to industry players worldwide
- Experts in investment promotion and cluster development including market and manufacturing incentive schemes
- Consultancy project record for states and regions in Germany, USA and Middle East
- International team of experienced consultants
- Country representative in emerging markets
### Institutional/governmental advisory – selected references.

<table>
<thead>
<tr>
<th>Client</th>
<th>Saudi Arabian governmental institution and KAUST – King Abdullah University of Science and Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Project summary: Development of a national solar strategy</td>
</tr>
<tr>
<td>Steps taken by Apricum</td>
<td>Location benchmarking vs. leading sites around the world for all segments of the value chain</td>
</tr>
<tr>
<td></td>
<td>Global R&amp;D best-practice analysis</td>
</tr>
<tr>
<td></td>
<td>Development of solar investment promotion strategy</td>
</tr>
<tr>
<td></td>
<td>Solar investor attraction and targeting</td>
</tr>
<tr>
<td>Result</td>
<td>Identification of high-potential solar R&amp;D fields</td>
</tr>
<tr>
<td></td>
<td>Full roadmap for the development of a solar industry</td>
</tr>
</tbody>
</table>

### Institutional/governmental advisory – selected references.

<table>
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<tr>
<th>Client</th>
<th>Portland Metropolitan Area, USA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Project summary: Cleantech positioning and investment attraction strategy</td>
</tr>
<tr>
<td>Steps taken by Apricum</td>
<td>Evaluate site attractiveness based on Cleantech manufacturer's decision model</td>
</tr>
<tr>
<td></td>
<td>Benchmark Portland sites in relation to alternative sites worldwide</td>
</tr>
<tr>
<td></td>
<td>Identify relevant site parameters that can be influenced on a local basis</td>
</tr>
<tr>
<td></td>
<td>Segment potential investors and set up meetings with selected companies</td>
</tr>
<tr>
<td></td>
<td>Interview potential investors for evaluation of Portland's site attractiveness</td>
</tr>
<tr>
<td>Result</td>
<td>Developed investor targeting strategy including measures to increase site attractiveness</td>
</tr>
</tbody>
</table>
**THEME 4: BREAKING THE WALL TO SUCCESS**

### Institutional/governmental advisory – selected references.

<table>
<thead>
<tr>
<th>Client</th>
<th>Economic development agency of the German Federal State of Saxony</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project summary</td>
<td>Develop investor attraction strategy for selected Cleantech industry segments</td>
</tr>
<tr>
<td>Steps taken by Apricum</td>
<td>Analyze market potential of selected Cleantech segments</td>
</tr>
<tr>
<td>Result</td>
<td>Investment attraction strategy completed within eight weeks; prepared client to approach investors in subsequent phase, assisted by Apricum</td>
</tr>
</tbody>
</table>

### Renewable industries turnover in Germany (2009).

- **Water**: EUR 1.4 million
- **Solar thermal**: EUR 4.9 million
- **Wind**: EUR 5.6 million
- **Biomass**: EUR 11.4 million
- **Solar PV**: 9 million

Total: EUR 33.37 million

Source: BMU 2010
### Capacities vs. Cell Production Share 2009

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>Uncapped FIT (since 1991)</td>
<td>9.100 MW</td>
<td>15.0%</td>
</tr>
<tr>
<td>Spain</td>
<td>Capped FIT (since 2008)</td>
<td>3.500 MW</td>
<td>1.0%</td>
</tr>
<tr>
<td>Japan</td>
<td>FIT (since 2008)</td>
<td>2.640 MW</td>
<td>12.6%</td>
</tr>
<tr>
<td>USA</td>
<td>Tax credits, RPS (since 2006)</td>
<td>1.380 MW</td>
<td>4.4%</td>
</tr>
<tr>
<td>South Korea</td>
<td>Capped FIT (uncapped until 2008)</td>
<td>453 MW</td>
<td>1.9%</td>
</tr>
<tr>
<td>Italy</td>
<td>Capped FIT (since 2005)</td>
<td>900 MW</td>
<td>0.7%</td>
</tr>
<tr>
<td>China</td>
<td>Capped regional tendering processes (since 2010)</td>
<td>200 MW</td>
<td>38.0%</td>
</tr>
<tr>
<td>France</td>
<td>FIT (since 2009)</td>
<td>285 MW</td>
<td>0.4%</td>
</tr>
</tbody>
</table>
Promoting the Energy Agenda
Eicke Weber, Director, Fraunhofer Institute for Solar Energy Systems (ISE)
eicke.weber@ise.fraunhofer.de

Prof. Dr. Eicke Weber introduced the work of the Fraunhofer Institute for Solar Energy Systems (ISE) and the Fraunhofer Energy Alliance. In his opinion, the transformation into a green energy future requires increased energy efficiency in buildings, transport and production, rapid development of all renewable energies towards a 100% renewable energy future and the expansion of the electricity grid for long-distance transport and interested consumers.
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Fraunhofer-Institute for Solar Energy Systems ISE

Largest European solar energy research institute
>930 members of staff (incl. students)

Areas of business:
• Photovoltaics
• Solar Thermal Technologies
• Renewable Power Generation
• Energy-Efficient Buildings and Technical Building Components
• Applied Optics and Functional Surfaces
• Hydrogen Technology

10% basic financing
90% contract research
40% industry, 60% public
€ 56 M total budget ('09)
> 10% p.a. growth rate

Fraunhofer Alliance Energy

Strong German research network of 14 institutes in energy efficiency and renewable energy technologies

- Partnership of Fraunhofer Center for Sustainable Energy Systems CSE in Boston with Massachusetts Institute of Technology (MIT), Cambridge, MA

Customer’s benefits
- New technologies for energy and efficiency
- Innovative and intelligent energy concepts
- Strengthened competitiveness and success in the market
We are Facing the Urgent Challenge of a Drastic Change in our Global Energy System

- Protection of the foundation of life as we know it by fast reduction of CO₂ emissions
- Limitation of fossil energy leads to increasing energy prices
- Reduction of geopolitical conflict potential based on fossil fuels

The Transformation into a Green Energy Future Requires:

- Increased energy efficiency in buildings, transport (e-mobility) and production
- Rapid development of all renewable energies, especially wind, PV, ST, hydro, geothermal and biomass towards a 100% renewable energy future
- Expansion of the electricity grid for long-distance transport and smart consumers

My suggestion for climate discussion:
Replace CO₂ reduction targets by Renewable Energy introduction targets!
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Exemplary Path, Global Primary Energy Consumption

Annual Installation of PV Modules (worldwide)

2009: 6,43 GWp
2003: 600 MWp
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Learning Curve of Crystalline Si PV Module Prices

![Graph showing the learning curve of crystalline Si PV module prices.](image)

Slide courtesy of G. Willeke

From mg-Si to Ultrapure poly-Si: the Siemens Process

- mg-Si powder
- exhaust (SiHCl₃, SiCl₄, H₂, Metall Chloride)
- hot Si dust quartz tube heating
- fluidised bed reactor
- fractional distillation
- Siemens Silicon Plant

Alternative Technology for PV: upgraded metallurgical Si, umg-Si, without using the gas phase

ca. 100,000 t/a
ca. $50/kg
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Solar Cell Conversion Efficiency with 100% umg-Si

- Median efficiency reaches 16%
- Record cells approaching 17%

High-Efficiency ISE Triple-Junction Solar Cells

- Ga_{0.65}In_{0.35}P: 1.7 eV
- Ga_{0.83}In_{0.17}As: 1.1 eV
- Ge substrate: 0.7 eV

η = 41.1%
Realization: FLATCON® System by Concentrix

- III-V based tandem cells
- $C_{geo} = 500x$
- Point focus Fresnel lenses
- Housing made of glass

Desertec - Vision of an Electricity Super Grid
THEME 4: BREAKING THE WALL TO SUCCESS

Intelligent Use of Energy (Smart Grids)

Future Structure of Electricity Supply: Supergrid with distributed Responsibilities

- Command Unit Distribution Operation
- Intelligent Grid Operation
- Prognosis: Generation and Consumption

Electricity Costs of Renewable Energies

- Electricity Costs depend on number of operating hours
- On-shore wind reaches parity with fossil energies
- PV at good locations competitive with CSP

Slide courtesy of C. Kist (Fraunhofer ISE)
THEME 4: BREAKING THE WALL TO SUCCESS

Electricity Cost and Learning Curve Prediction

- Steep PV learning curve results in costs that are competitive with conventional sources
- (Onshore-) wind is competitive today
- Offshore- wind has substantially higher costs, even long-term

Energy Use of Residential Buildings

End Energy Consumption in kWh/m²a

- Current Average
- New Code 1995
- New Code 2002
- 3-Liter House
- Passiv-House
- + PV

Source: C. Kies, Fraunhofer ISE
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Employment in Selected Industries in Germany
1998-2008


Conclusion: The Green Energy Future

- The world is moving towards a green energy future; the open question is, how fast will we come there
- The goal is 100% renewable energy generation at greatly increased efficiency in energy consumption
- This transition of the global energy market provides exciting opportunities to transfer innovation into jobs
- Countries that blaze this trail will have great economic advantages in the form of stable energy prices and jobs in high- and low-tech sectors
- Fraunhofer institutes are ideally prepared to work with research institutions and industry in ECA countries to accelerate this exciting development